

BOBBS MERRILL ARITHMETICS

BOOK TWO
PART ONE



KENT

BOBBS-MERRILL ARITHMETICS

Book Two

FIFTH GRADE

BY

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FOREWORD

This series of arithmetics makes a carefully planned attempt to combine the psychology of number-learning with the best experience of successful class-room practice. Especially is the principle employed that the primary purpose of arithmetic is to put into the hands of the child a well-mastered tool for use in the practical affairs of his every-day living.

The following characteristics stand out sharply in this and the other volumes of the series:

1. Simplicity of approach to each new topic. The new is introduced on a foundation of familiar material in so natural a manner that the advanced step is easily taken by the average child.

2. An unusual amount of well distributed review and practice is provided for. The *processes* of arithmetic must become so much a matter of course and so accurate that the element of automatism enters in if skill is to result. The fundamental operations cannot be "learned" and then left to themselves. No other arithmetics, the authors believe, provide as well for this feature as the present series.

3. The reasoning aspect of arithmetic study is made to spring from problems arising directly out of familiar and typical environment. A good problem presents not only a possible but a probable situation—even more than that, an *actual* situation. These texts avoid the artificial made-to-order type of problem, and go to current social life—the life of the pupil now and the life around him—for their problem materials.

FOREWORD

4. By simplicity of explanation, by fulness of direction and by abundance of practice material these texts recognize the principle of rendering the pupil as independent of help from the teacher as may be. No text-book for young pupils can be made wholly self-teaching; the better the teacher the more the pupil will get from the best of text-books. Yet there is a vast difference as to the "learnability" of various text-books. The authors believe that this quality inheres in the present text and in the series to an unusual degree.

5. Extensive use of timed tests and drills makes it possible to employ the spirit of emulation among pupils, and gives the teacher a valuable measure of the individual differences and the class average of his pupils.

BOOK TWO is divided into two Parts, and is intended for grades five and six. The materials are in agreement with the more carefully worked out courses of study, and lay a strong foundation for the work of the last two elementary grades or the Junior High School.

Acknowledgment is here made and grateful appreciation expressed to Miss Inez Beardsley, Principal of East Ward School and Supervisor of Grammar Grades, Greeley, Colorado; to Miss Annie McCowan of State Teachers College, Greeley, Colorado; and to Miss Frances Smith, formerly of State Teachers College, Winona, Minnesota, for helpful suggestions growing out of critical reading of the manuscript.

Teachers will welcome the carefully developed *Manual* which accompanies the present volume, offering many suggestions for presenting the topics and providing additional materials for practice.

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BOBBS - MERRILL

ARITHMETICS

BOOK TWO

FIFTH GRADE

I. REVIEW AND EXPANSION OF WORK OF PREVIOUS GRADES

1. Reading and Writing of Numbers through Millions; Meaning of Periods and Orders, Roman Numerals.

Fred was reading aloud to his father and mother from the newspaper. The article was about immigrants coming to this country. He came to the statement, "In one year 1,263,524 immigrants were admitted into the United States." "But," said Fred, "I can't read that big number," so his father had to help him.

While most of the numbers we commonly have to deal with are rather small, still every one wants to be able to read and understand larger numbers as well. For we constantly find large numbers used in the books, newspapers and magazines which we read.

For such matters as the following and many others we require large numbers:

When we refer to the state or national yield of crops.



When in geography we study the areas or crops of various countries.

When we discuss the cost of running our schools or the government.

When we speak of the distance the planets are away.

The purpose of this section of the book is to help you learn how to read, write and understand large numbers.

In 1920 the city of Philadelphia had one million, eight hundred twenty-three thousand, seven hundred seventy-nine people living in it. How shall we write this number in figures?

When more than three figures are needed to write a whole number the figures are separated by commas into groups of three. Each of these groups is called a **PERIOD**.

Each period has three places, *units*, *tens* and *hundreds*. These places are called **ORDERS**. Periods and orders are illustrated just below:

Periods:	<i>Millions</i>			<i>Thousands</i>			<i>Units</i>		
Orders:	Hundreds	Tens	Units	Hundreds	Tens	Units	Hundreds	Tens	Units
Population of Philadelphia:			1,	8	2	3,	7	7	9

To read a number we first name the *orders* of each period; then we name the *period*. For example, we read the number representing the population of Philadelphia like this: One **MILLION**, eight hundred twenty-three **THOUSAND**, seven hundred seventy-nine. (It is not necessary in reading numbers, to name the first period, **UNITS**, for this is understood.)

The next period above million is *billion*, and then next above billion is *trillion*.

Prepare in your note-book a scheme showing the *periods* and *orders* as in the illustration at the top of this page. Next write these numbers underneath, being careful to place each figure exactly under the order and period to which it belongs. Then read each number noting the *order* and *period* to which each figure belongs.

- | | | |
|---------------|----------------|----------------|
| 1. 765,031 | 4. 156,204,500 | 7. 10,810,350 |
| 2. 6,524,823 | 5. 935,254,008 | 8. 600,560,035 |
| 3. 42,605,931 | 6. 105,346,906 | 9. 1,001,264 |

Separate the following numbers into periods and then read them:

- | | | |
|--------------|--------------|--------------|
| 1. 5346487 | 4. 160535600 | 7. 44000257 |
| 2. 66153056 | 5. 100650032 | 8. 276532000 |
| 3. 584347697 | 6. 31460520 | 9. 800650314 |

Write the following facts in figures:

1. In 1920 the city of New York had a population of five million, six hundred twenty thousand, forty-eight.

It is difficult really to understand what such large numbers stand for. Perhaps an illustration will help. Suppose the population of New York should form in columns of fours and start to march from New York to Chicago, with the fours 4 feet apart. When the head of the column reached Chicago, the foot of the column would only be leaving New York,—a solid column of fours reaching from New York to Chicago. If this column marched two miles an hour 24 hours a day it would require more than twenty days for it to pass a given point.

2. During the year 1923, the regular army of the United States consisted of one hundred thirty-two thousand, eight hundred thirty-four men.

To picture this number of men, think of how many persons are in your town or city, or in one near by. Think of them all gathered in one place at the same time. Then compare this number with the number of soldiers.

For each of the nine problems that follow, try to think of an illustration that will help show what the large numbers mean.

3. In the United States there were in 1920 seven hundred ten thousand, six hundred miles of railways.
4. In the same year there were one million, five hundred ninety-two thousand miles of telegraph wires.
5. The United States has an area of three million, seven hundred forty-three thousand, five hundred twenty-nine square miles.
6. The highest mountain in North America, Mt. McKinley, is twenty thousand, three hundred feet high.
7. The highest mountain peak in the world is Mt. Everest which is twenty-nine thousand, two feet high.

8. There were eighty-three million, three hundred ninety-eight thousand, eight hundred ninety-four dollars' worth of oranges grown in the United States in 1920.
9. In the same year the United States grew one million, one hundred twenty-five thousand, one hundred acres of peanuts.
10. The United States grew eighty-seven million, seven hundred seventy-one thousand, six hundred acres of corn in 1920.
11. The United States published twenty-two thousand one hundred sixty-three daily and weekly newspapers in 1924.

Be prepared to read these facts aloud in class. Perhaps the teacher will then dictate the numbers for you to write.

1. In 1920 there were 13,920,692 foreign born persons ten years of age and over living in the United States.
2. Of this group there were 1,488,948 who were unable to speak English.
3. According to the United States census there were in 1920, 21,694,299 persons between five and twenty years of age attending school in this country.
4. Of this number 19,644,508 were white, and 2,049,791 were negro.
5. According to the last federal census there were 54,304,603 persons living in towns or cities and 52,406,017 living in villages or open country in the United States.
6. The value of nuts raised in the United States in one year was \$29,714,396.

6 WRITING AND READING LARGE NUMBERS

7. There were manufactured in a recent year in the United States 331,224,628 pairs of boots, shoes and slippers.

Write these numbers in figures and then read them from the figures you have written:

1. Ninety-five million, one hundred seventeen thousand, three hundred fifty-six.
2. Four hundred forty-seven million, twenty-five thousand, one hundred eighty-four.
3. One million, twenty-one thousand, seven hundred forty-eight.
4. Three hundred five million, twenty-five thousand, one hundred.
5. Seventy-five million, one thousand, two hundred five.
6. Three hundred million, eight hundred seventy-five.
7. Two million, ten thousand, twenty.
8. Seventy million, six hundred fifty thousand, twenty-five.

Find the answers to these problems:

1. The population of the United States in 1920 was 106,418,284. In 1924 it was 112,078,611. How much greater was it in 1924?
2. In a certain year New York City had a population of 5,620,048 and Chicago had 2,701,705. How many more people had New York than Chicago?
3. The states were allowed one representative in Congress for:

33,000 people in 1790	127,381 people in 1860
35,000 people in 1810	131,425 people in 1870
40,000 people in 1820	151,911 people in 1880
47,000 people in 1830	173,901 people in 1890
70,000 people in 1840	194,182 people in 1900
93,423 people in 1850	211,877 people in 1910

Find the population of your state and also the number of representatives it has in Congress. How many persons are there for each representative?

4. From New York to Los Angeles it is 3111 miles and from New York to San Francisco it is 3180 miles. How much farther is it to San Francisco?
5. The wheat crop in the United States for the following years was:

1914,	891,017,000 bushels
1915,	1,025,801,000 bushels
1916,	636,318,000 bushels
1917,	636,655,000 bushels
1918,	921,438,000 bushels
1919,	967,979,000 bushels
1923,	785,741,000 bushels

In what year was the largest production? In what year was the next largest?

6. The corn crop in the United States for the following years was:

1914,	2,672,804,000 bushels
1915,	2,994,793,000 bushels
1916,	2,566,927,000 bushels
1917,	3,065,233,000 bushels
1918,	2,502,665,000 bushels
1919,	2,811,302,000 bushels
1923,	3,054,395,000 bushels

In what year was the most corn produced? Does the United States produce more corn or more wheat?

7. The following table gives the amount of money spent by our government:

1920,	\$6,482,000,000
1921,	5,538,000,000
1922,	3,795,000,000
1923,	3,507,000,000

8. The world's cotton crop of 1924 was produced by:

United States.....	10,128,000 bales
India.....	4,247,000 bales
Egypt.....	1,213,000 bales
Brazil.....	719,000 bales
Russia (Asiatic)....	321,000 bales
Mexico.....	138,000 bales

9. Find large numbers in the newspapers or magazines and bring them to class and read them.
10. Read the numbers on at least ten automobiles, copy them down and read them to the class.

Roman Numerals

The system of writing numbers originally used by the Romans is no longer employed in ordinary computations. We need to be able to read and write the Roman numerals, however, for this system is still extensively used on the faces of clocks and watches, on monuments, tablets, the cornerstones of buildings, and occasionally in giving the dates of documents or books. The chapters of books are often numbered by the Roman system.

The following seven capital letters are used as Roman numerals:

I = 1	L = 50
V = 5	C = 100
X = 10	D = 500
M = 1000	

These rules will help you in learning to read and write the Roman system:

a. Repeating a letter adds its value, thus:

$$\text{CC} = 200 \qquad \text{XXX} = 30$$

A numeral is generally not used more than three times in succession, thus: III. Four is not IIII, but IV.

b. Placing a letter after another of greater value adds its value to the larger, thus:

$$\text{XI} = 11 \qquad \text{LV} = 55 \qquad \text{CX} = 110$$

c. Placing a letter before another of greater value subtracts the smaller from the larger, thus:

$$\text{IX} = 9 \qquad \text{XL} = 40 \qquad \text{VC} = 95$$

d. Placing a letter between two other letters, each of greater value subtracts its value from their sum, thus:

$$\text{XIX} = 19$$

$$\text{CXL} = 140$$

$$\text{CIX} = 109$$

1. Write in Roman numerals the number of years you are old.
2. Write in Roman numerals the number of months you are old.
3. Write your weight in Roman numerals.
4. Write the number of inches you are tall in Roman numerals.
5. Write the present year in Roman numerals.
6. Write the year of the beginning and ending of the World War in Roman numerals.
7. Write in our numerals these numbers:

a. IX =	e. LXVI =	i. CCCXL =
b. XII =	f. CIX =	j. MCMLX =
c. XVIII =	g. XC =	k. MDCCXIV =
d. XIX =	h. MC =	l. MCDIXL =
8. On the cornerstone of George's schoolhouse is cut "Erected MCMXXIV." When was the schoolhouse built?
9. An inscription on an old tombstone reads, "Died on the tenth day of August MDCCXL." In what year did the death occur?
10. Find on public buildings, monuments, or in other places dates written in Roman numerals; copy them, bring them to class and read them.

2. Addition.*

To be good in arithmetic one must be able to add and subtract both *rapidly* and *accurately*.

Two words used in addition:

Addends: The numbers you add.

Sum: The answer you get when you add.

$$\begin{array}{r} 15 \\ 26 \\ 35 \\ \hline 76 \end{array}$$

Addends (The numbers you add)

Sum (Answer)

1. Practice on this exercise until you can give all the sums orally in *one minute or less* getting every sum right. State only the sums, do not read the numbers.

$$\begin{array}{r} 5 \quad 4 \quad 5 \quad 6 \quad 3 \quad 7 \quad 8 \quad 2 \quad 5 \quad 3 \\ \hline 5 \quad 2 \quad 2 \quad 3 \quad 9 \quad 2 \quad 3 \quad 2 \quad 3 \quad 2 \end{array}$$

$$\begin{array}{r} 9 \quad 2 \quad 4 \quad 3 \quad 2 \quad 2 \quad 7 \quad 4 \quad 6 \quad 9 \\ \hline 2 \quad 6 \quad 3 \quad 3 \quad 1 \quad 8 \quad 3 \quad 4 \quad 5 \quad 6 \end{array}$$

$$\begin{array}{r} 5 \quad 7 \quad 8 \quad 4 \quad 7 \quad 6 \quad 6 \quad 9 \quad 9 \quad 7 \\ \hline 4 \quad 9 \quad 8 \quad 9 \quad 4 \quad 8 \quad 6 \quad 8 \quad 9 \quad 7 \end{array}$$

$$\begin{array}{r} 6 \quad 5 \quad 4 \quad 4 \quad 5 \quad 7 \quad 9 \quad 7 \quad 8 \quad 7 \\ \hline 7 \quad 9 \quad 8 \quad 6 \quad 8 \quad 5 \quad 6 \quad 8 \quad 9 \quad 6 \end{array}$$

2. Practice on this exercise until you can give all the sums orally in *one minute or less*. State only the sums. Every sum must be correct.

*The practice exercises that follow may be broken up and used for occasional drills instead of being used in succession.

5	1	6	6	3	6	2
<u>15</u>	<u>19</u>	<u>14</u>	<u>15</u>	<u>17</u>	<u>16</u>	<u>18</u>

5	7	4	3	6	2	7
<u>17</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>17</u>	<u>19</u>	<u>17</u>

4	8	9	9	4	3	9
<u>19</u>	<u>17</u>	<u>19</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>18</u>

6	5	8	7	6	7	9
<u>18</u>	<u>19</u>	<u>18</u>	<u>19</u>	<u>19</u>	<u>18</u>	<u>18</u>

3. Practice this exercise until you can give all the sums orally in *one and one-half minutes*, getting every sum correct.

5	7	19	3	7	8	6
<u>25</u>	<u>26</u>	<u>27</u>	<u>28</u>	<u>29</u>	<u>25</u>	<u>26</u>

4	6	5	6	9	8	5
<u>27</u>	<u>29</u>	<u>26</u>	<u>27</u>	<u>26</u>	<u>27</u>	<u>29</u>

4	3	5	8	8	7	4
<u>28</u>	<u>29</u>	<u>28</u>	<u>28</u>	<u>26</u>	<u>25</u>	<u>26</u>

4	7	6	3	2	9	6
<u>29</u>	<u>28</u>	<u>25</u>	<u>27</u>	<u>29</u>	<u>28</u>	<u>28</u>

9	9	2	7	5	8	7
<u>29</u>	<u>25</u>	<u>28</u>	<u>24</u>	<u>27</u>	<u>29</u>	<u>27</u>

4. Practice on this exercise until you can give all the sums orally in *one and one-half minutes*.

5	9	4	3	7	3	5
<u>35</u>	<u>36</u>	<u>38</u>	<u>39</u>	<u>35</u>	<u>37</u>	<u>38</u>

4	8	4	5	8	3	4
<u>39</u>	<u>35</u>	<u>37</u>	<u>39</u>	<u>36</u>	<u>38</u>	<u>36</u>

6	9	5	6	6	7	6
<u>35</u>	<u>35</u>	<u>37</u>	<u>38</u>	<u>39</u>	<u>36</u>	<u>36</u>

7	9	9	9	7	8	5
<u>37</u>	<u>37</u>	<u>39</u>	<u>38</u>	<u>39</u>	<u>37</u>	<u>36</u>

6	7	8	8	6	9	5
<u>37</u>	<u>38</u>	<u>38</u>	<u>39</u>	<u>35</u>	<u>36</u>	<u>37</u>

8	9	4	7	9	4	5
<u>39</u>	<u>35</u>	<u>39</u>	<u>35</u>	<u>36</u>	<u>37</u>	<u>39</u>

5. Practice on this exercise until you can give all the sums orally in *one and one-half minutes*. Remember every sum must be correct.

5	9	3	7	9	3	9
<u>45</u>	<u>43</u>	<u>49</u>	<u>46</u>	<u>47</u>	<u>48</u>	<u>48</u>

6	6	5	9	4	7	4
<u>48</u>	<u>47</u>	<u>46</u>	<u>45</u>	<u>47</u>	<u>45</u>	<u>48</u>

6	8	8	6	8	7	9
<u>48</u>	<u>43</u>	<u>49</u>	<u>49</u>	<u>44</u>	<u>44</u>	<u>49</u>

TIMED PRACTICE

2	5	9	9	8	8	7
<u>49</u>	<u>49</u>	<u>42</u>	<u>44</u>	<u>48</u>	<u>47</u>	<u>47</u>

5	5	3	6	6	8	8
<u>48</u>	<u>47</u>	<u>47</u>	<u>46</u>	<u>45</u>	<u>45</u>	<u>46</u>

7	4	7	9	7	9	8
<u>49</u>	<u>49</u>	<u>48</u>	<u>46</u>	<u>48</u>	<u>45</u>	<u>49</u>

6. Practice on this exercise until you can give all the sums orally in *one and one-half minutes*, getting every sum correct. State only the sums.

9	6	8	9	7	9	4
<u>18</u>	<u>29</u>	<u>37</u>	<u>49</u>	<u>17</u>	<u>26</u>	<u>39</u>

9	5	9	6	3	9	2
<u>37</u>	<u>47</u>	<u>45</u>	<u>58</u>	<u>19</u>	<u>44</u>	<u>29</u>

9	8	9	6	7	5	8
<u>13</u>	<u>29</u>	<u>32</u>	<u>45</u>	<u>29</u>	<u>36</u>	<u>48</u>

5	8	7	8	4	8	4
<u>44</u>	<u>17</u>	<u>24</u>	<u>36</u>	<u>48</u>	<u>13</u>	<u>27</u>

8	7	6	3	8	7	6
<u>35</u>	<u>48</u>	<u>17</u>	<u>28</u>	<u>34</u>	<u>46</u>	<u>16</u>

5	6	5	8	7	8	6
<u>28</u>	<u>39</u>	<u>49</u>	<u>16</u>	<u>28</u>	<u>47</u>	<u>49</u>

7. Practice until you can write the answers to these ten examples in *five minutes* or less, getting every one right.

A.	B.	C.	D.	E.
568	678	729	429	894
479	789	485	768	673
342	432	346	543	295
831	156	674	697	714
<u>126</u>	<u>543</u>	<u>295</u>	<u>862</u>	<u>629</u>

F.	G.	H.	I.	J.
486	592	246	594	893
527	678	369	367	724
469	765	854	529	853
875	432	678	486	789
<u>678</u>	<u>124</u>	<u>943</u>	<u>674</u>	<u>126</u>

8. Practice until you can write the sums of these examples in *three minutes* or less, getting all sums correct.

A.	B.	C.	D.	E.	F.	G.	H.	I.	J.
7	9	8	5	9	7	9	4	2	2
2	6	5	7	5	9	9	7	6	8
5	5	0	2	3	5	6	7	1	6
4	2	6	4	8	3	3	4	7	9
9	7	4	8	3	3	3	7	9	4
6	4	5	1	8	8	6	9	5	2
3	3	2	3	4	8	7	1	0	9
6	6	1	7	7	4	8	5	8	3
<u>8</u>	<u>1</u>	<u>7</u>	<u>9</u>	<u>4</u>	<u>4</u>	<u>6</u>	<u>3</u>	<u>3</u>	<u>1</u>

9. John's father was going to build a new house. John asked how much it would cost. His father said, "Here is the estimate."

Basement excavating and wall.....	\$ 496.50
Contract covering all lumber and carpenter work.....	3649.00
Chimney and fireplace.....	210.70
Plastering.....	649.25
Painting.....	214.20
Hardware.....	175.95
Electric wiring and fixtures.....	80.55
Plumbing.....	475.00
Furnace.....	235.75
Grading.....	64.00
Sidewalk.....	110.60

How much was the house to cost?

Questions to Answer

- How many *places*, or orders, are there in each *period*?
Name these orders or places.
- Of how many periods do you know the names?
Name all the periods you know.
- Write a number of six figures. How many periods are there in it? What is the name of the first period?
What is the name of the second period?
- What are the names of the places or orders in each of the periods in the number you wrote?
- What are the seven letters used in Roman numerals?
What is the value of each?

10. John's mother asked him to check the grocer's bill and see whether it was correct. Was it?

THE ACME GROCERY COMPANY		
NEWARK, N. J.		
SOLD TO _____		
10 lb.*	Granulated sugar @ 6¢	\$.60
1 lb.	Tea	.42
2 lb.	Coffee @ 48¢	.96
50 lb.	Best flour	2.25
1 doz.	Bars laundry soap	.60
5 gal.	Kerosene @ 17¢	.85
1 bu.	Apples	1.20
3 bu.	Potatoes @ 70¢	2.10
2 cans	Tomatoes @ 21¢	.42
		\$9.50

* lb. means pound or pounds.

11. Tell at sight the change you should receive from a one-dollar bill for purchases as indicated. Think each time how many cents you would have to **add** to the amount of the purchase to make one dollar.

MAKING CHANGE

a. \$.85	f. \$.84	k. \$.65
b. .40	g. .17	l. .85
c. .73	h. .54	m. .15
d. .35	i. .27	n. .75
e. .55	j. .30	o. .45

12. Tell at sight the change you should receive from a *two-dollar* bill for purchases as indicated. Think how much you would have to add to the amount of the purchase to make two dollars. If the amount of the purchase is less than one dollar, *first think how many cents you would have to **add** to make one dollar*; then add to this one dollar.

a. \$1.25	f. \$1.20	k. \$1.15
b. .75	g. .20	l. 1.38
c. 1.40	h. .55	m. 1.76
d. 1.60	i. .85	n. 1.87
e. .60	j. .70	o. 1.45

13. Tell at sight the change you should receive from a *five-dollar* bill for purchases as indicated. First think how many cents you would have to add to make *the next dollar above the purchase*; then ***add** to this the number necessary to make five dollars*.

a. \$4.25	f. \$.75	k. \$.45
b. .25	g. 2.80	l. 2.90
c. 3.50	h. 1.80	m. 4.40
d. 1.75	i. 2.20	n. 1.10
e. 2.55	j. 4.16	o. 3.15

Problems in Addition

14. The Hawthorne School has eight rooms. The number of pupils in the rooms is as follows: first grade, 47; second grade, 45; third grade, 42; fourth grade, 39; fifth grade, 41; sixth grade, 38; seventh grade, 35; eighth grade, 34. How many pupils in the school?
15. The Bryant School has a dental clinic where all the pupils may have their teeth examined and treated. This is the record of treatments for one week: Monday, 24; Tuesday, 17; Wednesday, 9; Thursday, 16; Friday, 33. How many pupils were treated during the week?
16. Eight boys wanted to hire a truck to take them and their baggage to a camp where they were going to spend a week. The driver told them his light truck could not carry more than 1000 pounds besides some things of his own. Joe weighs 89 lb., Tom 76 lb., Henry 94 lb., George 83 lb., John 68 lb., William 69 lb., Glenn 95 lb., Raymond 86 lb., the driver 173 lb. The boys had baggage amounting to 156 pounds. Would the load be too heavy for the truck?
17. Elizabeth went to the grocery for her mother and bought goods as follows: sugar 87¢, tea 42¢, butter 56¢, soap 28¢, salt 17¢, flour 85¢, fruit 35¢. She handed the grocer a five-dollar bill. How much change should she receive in return?
18. The Bancroft School and the Roosevelt School were in a contest for the best record in the amount of money deposited in the school bank. Their monthly deposits for the school year were as follows:

Bancroft School

Sept.	\$189.25
Oct.	134.17
Nov.	201.38
Dec.	78.56
Jan.	155.24
Feb.	172.87
Mar.	192.15
Apr.	169.82
May	215.37

Roosevelt School

Sept.	\$164.26
Oct.	157.33
Nov.	194.82
Dec.	125.14
Jan.	137.65
Feb.	184.29
Mar.	166.72
Apr.	150.34
May	198.94

Which school won the contest? By how much was it ahead?

19. John's father sold seven hogs whose weights were: 225 lb., 318 lb., 276 lb., 287 lb., 306 lb., 291 lb., 248 lb. What was their combined weight?
20. The public library had this record of its books loaned: Monday 125, Tuesday 87, Wednesday 117, Thursday 92, Friday 139, Saturday 237. How many were loaned for the week?
21. Tom weighs 76 pounds and Harry is 18 pounds heavier than Tom. They both got on the scales at once. What weight did the scales show?
22. The paid admissions at the moving-picture house at Grantville were as follows for one week:

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.
Adults.....	374	286	455	384	298	474
Children.....	135	118	147	109	124	389

How many adults for the week? How many children?
How many paid admissions?

Speed and Accuracy Practice

Test yourself for speed and accuracy by adding this list.
Practice until you can find the correct sums at the rate of
one example per minute.

23.	24.	25.	26.	27.	28.
868	523	788	736	977	257
856	298	215	994	356	764
989	735	931	672	713	544
654	510	342	717	831	398
139	981	896	468	943	258
731	738	146	032	129	193
793	195	651	454	892	553
279	422	214	509	965	615
<u>552</u>	<u>122</u>	<u>512</u>	<u>425</u>	<u>381</u>	<u>429</u>

29.	30.	31.	32.	33.	34.
762	269	432	336	424	822
578	722	889	740	788	786
346	837	524	783	165	861
323	998	199	129	619	687
589	071	743	469	977	779
143	566	636	923	124	415
434	149	397	578	632	930
767	547	461	386	098	593
<u>443</u>	<u>142</u>	<u>941</u>	<u>173</u>	<u>303</u>	<u>338</u>

35. Harry's father had just had the winter coal put in. He asked Harry to figure from the following record the amount of coal that had been delivered: first load, 3976 lb.; second load, 4115 lb.; third load, 3825 lb.; fourth load, 4374 lb.; fifth load, 3944 lb.; sixth load, 3678 lb.; seventh load, 4088 lb.; eighth load, 3765 lb. How many pounds were delivered?
36. What problems have you had to work recently in buying or selling or some other enterprise in which you were interested, where you had to use addition? Were you accurate and rapid in your adding? Did you check by adding in reverse order?

3. Subtraction.

Three words used in subtraction:

Minuend: The number from which you subtract.

Subtrahend: The number you subtract.

Remainder: The answer, or what is left.

265	Minuend
<u>142</u>	Subtrahend
123	Remainder (Answer)

To be skilled in the use of numbers you must be able to combine two things,—*accuracy* and *speed*. Therefore in practicing on these subtractions *do them rapidly*, but *get them right*.

Subtract:

1.	2.	3.	4.	5.
240	360	450	380	510
<u>137</u>	<u>257</u>	<u>259</u>	<u>276</u>	<u>398</u>

6.	7.	8.	9.	10.
610	410	310	910	810
<u>275</u>	<u>287</u>	<u>295</u>	<u>463</u>	<u>708</u>

Subtract. These may be harder than the ones just above, but try for a record of speed and accuracy.

11.	12.	13.	14.	15.
500	900	600	700	400
<u>486</u>	<u>294</u>	<u>528</u>	<u>225</u>	<u>296</u>
16.	17.	18.	19.	20.
200	300	800	700	100
<u>195</u>	<u>284</u>	<u>787</u>	<u>245</u>	<u>98</u>

Subtract. Work fast, be sure you are correct.

21.	22.	23.	24.
19,084	82,037	72,906	87,004
<u>17,496</u>	<u>28,642</u>	<u>29,437</u>	<u>29,247</u>
25.	26.	27.	28.
37,090	39,987	78,806	67,742
<u>29,987</u>	<u>36,542</u>	<u>29,907</u>	<u>57,436</u>

Problems

- 29.** Virginia's birthday was on September 30. On that day she asked her father how many days it would be till Christmas. He told her that September 30th was the 273rd day of the year and Christmas the 359th day of the year, and that she could find the answer to her question by subtracting. What was the answer to her question?

30. Jennie had in her purse \$3.50. She spent \$2.59. How much had she left?
31. There are just 500 pupils in the Washington School. On Tuesday there were 484 present. How many were absent?
32. Joe's family started on an automobile trip of 800 miles. After four days' run the speedometer showed a record of 696 miles. How far had they yet to go?
33. George had an accident with his bicycle and it will cost \$7 to repair it. George has \$2.87. How much more will he need to pay the bill?
34. Mary wants a new hat that costs \$3. She has \$1.45. How much does she lack of having enough for the hat?
35. Leonard and Henry each had a pony and each claimed that his pony was the heavier. They weighed them and Leonard's pony weighed 810 pounds and Henry's 708 pounds. How much heavier was Leonard's pony than Henry's?
36. The city of Ortonville has a population of 87,741 and Crossville a population of 77,537. How much larger is Ortonville?
37. Ernest has \$7.10. If he buys shoes costing \$3.75 will he have enough to buy a sweater that costs \$3.50?
38. Mr. Smith owed a bill of \$870.04. He paid \$593.48. How much still remained to pay?
39. The average weight of boys eleven years old is 77 pounds. Joe weighs 81 pounds, Tom 69 pounds, George 78 pounds, Harry 86 pounds, Ned 72 pounds. How

much is each above or below the average for his age if each is eleven years old?

40. In one year the United States raised 10,128,000 bales of cotton, and India 4,247,000 bales. How many more bales were produced in the United States than in India?

Practice in Subtraction

Do these exercises as fast as you can and do them right. Time yourself and keep a record of the number of errors. Do the list over again to-morrow and try to improve your record. Write only the answers:

41.	42.	43.	44.	45.
2722	2372	1425	2634	2492
<u>724</u>	<u>695</u>	<u>388</u>	<u>725</u>	<u>695</u>

46.	47.	48.	49.	50.
3826	7859	8349	7249	5948
<u>929</u>	<u>3946</u>	<u>2388</u>	<u>3364</u>	<u>3274</u>

51.	52.	53.	54.	55.
6937	7249	9654	2694	9200
<u>2148</u>	<u>2348</u>	<u>2378</u>	<u>1725</u>	<u>1784</u>

56.	57.	58.	59.	60.
4900	7000	9000	2000	10000
<u>2876</u>	<u>6794</u>	<u>8437</u>	<u>1987</u>	<u>8479</u>

Time and Accuracy Test in Subtraction

You should become able to do the ten examples in each of the following lists in the time indicated, getting *all correct*. If you cannot meet this test you need more practice in subtraction. Write only the answers.

Test One: 5 minutes.

61.	62.	63.	64.	65.
13973	89643	91365	35762	31673
<u>1520</u>	<u>37956</u>	<u>89204</u>	<u>32510</u>	<u>20481</u>
66.	67.	68.	69.	70.
12838	37216	54931	27319	32733
<u>10643</u>	<u>15392</u>	<u>24637</u>	<u>24256</u>	<u>24372</u>

Test Two: 5 minutes.

71.	72.	73.	74.	75.
23527	54138	54205	87038	71982
<u>14065</u>	<u>10427</u>	<u>36041</u>	<u>30419</u>	<u>43718</u>
76.	77.	78.	79.	80.
98064	54735	59398	73264	85473
<u>37596</u>	<u>30541</u>	<u>48659</u>	<u>27035</u>	<u>25614</u>

Test Three: $5\frac{1}{2}$ minutes.

81.	82.	83.	84.	85.
80765	67392	89306	72948	51398
<u>29537</u>	<u>12729</u>	<u>19738</u>	<u>63879</u>	<u>39297</u>
86.	87.	88.	89.	90.
49216	65376	40562	74685	83764
<u>35804</u>	<u>42734</u>	<u>30946</u>	<u>36418</u>	<u>54793</u>

4. Multiplication.

Three words used in multiplication:

Multiplicand: The number multiplied.

Multiplier: The number by which you multiply.

Product: The number you get by multiplying (Answer)

$$\begin{array}{r}
 564 \text{ Multiplicand} \\
 23 \text{ Multiplier} \\
 \hline
 1692 \\
 1128 \\
 \hline
 12972 \text{ Product (Answer)}
 \end{array}$$

Whenever in multiplying the multiplier consists of more than one figure, you must of course add the partial products. Therefore in all such multiplication you must be accurate both in *multiplying* and in *adding*. In working these examples try for both *accuracy* and *speed*. Give close attention, work fast, get the answers right every time if you can.

Multiply. Watch against mistakes with the zeros.

1.	2.	3.	4.
24	57	96	82
<u>14</u>	<u>45</u>	<u>24</u>	<u>13</u>
5.	6.	7.	8.
68	79	68	38
<u>65</u>	<u>38</u>	<u>15</u>	<u>75</u>
9.	10.	11.	12.
68	97	49	82
<u>96</u>	<u>18</u>	<u>64</u>	<u>94</u>
	13.	14.	
	76	46	
	<u>97</u>	<u>23</u>	

Multiply:

15. 422 <u>101</u>	16. 648 <u>201</u>	17. 537 <u>809</u>	18. 24 <u>40</u>	19. 62 <u>700</u>
20. 325 <u>160</u>	21. 720 <u>240</u>	22. 860 <u>790</u>	23. 570 <u>860</u>	24. 720 <u>540</u>
25. 394 <u>86</u>	26. 498 <u>59</u>	27. 672 <u>47</u>	28. 387 <u>28</u>	29. 972 <u>94</u>
30. 675 <u>86</u>	31. 972 <u>38</u>	32. 479 <u>29</u>	33. 675 <u>78</u>	34. 967 <u>85</u>

Problems in Multiplication

- 35.** In planning for a summer trip in his automobile, Mr. Brown estimated that the cost for gasoline, oil, wear on tires, etc., would average 9 cents per mile. The trip covered 1235 miles. What was the expense for the automobile?
- 36.** The fifth grade has 49 pupils. If their arithmetic texts cost 64 cents each what will be the cost of enough books to supply the class?
- 37.** The Lincoln School bought 94 dozen pencils at 46 cents a dozen. What was the amount of the bill?

38. A merchant bought 527 boys' suits which cost \$8.25 each. What was their total cost?
39. It costs \$73 annually for each pupil in the grade schools of a certain city. If there are 35 pupils in a room what is the cost of their schooling for a year?
40. A dealer sold 325 pairs of shoes at an average profit of \$2.40 per pair. What was his total profit?
41. It cost a certain city \$5.30 a month for each of 620 street lights. What was the monthly light bill?
42. A fruit dealer sold during a year 394 crates of oranges averaging 78 to the crate. He received for these oranges an average price of 4 cents each. What was the total amount he received for them?
43. A farmer sold 967 bushels of corn at 78 cents a bushel. How many dollars did he receive?
44. John's father asked him to figure up the following record of what had been sold from their farm for the month of September:

34 lb. butter	@ 42¢ = \$_____
68 bu. potatoes	@ 75¢ = _____
84 qt. berries	@ 13¢ = _____
18 chickens	@ 64¢ = _____
38 doz. eggs	@ 40¢ = _____
79 lb. honey	@ 30¢ = _____
	Total = \$_____

John figured up the amount and said that a total of \$127.52 had been received. Was John right?

45. The Smith family found they must have the following repairs for their car. What did the repairs cost?

4 tires	@ \$21.60
4 inner tubes	@ 3.45
3 spark plugs	@ .75
1 battery	@ 19.75
4 piston rings	
put in	@ 5.60

46. If coal costs \$11.80 a ton and a family uses 17 tons for the winter, what does the heating of their house cost?
47. Lucy needed the following for some sewing she was doing:

9 yd. gingham	@ 35¢
3 yd. ribbon	@ 17¢
3 spools thread	@ 6¢
2 doz. buttons	@ 16¢

She said the cost would be \$4.62. Was she right?

48. Charles has an allowance of 30 cents a week and his younger sister, Katherine, has an allowance of 25 cents a week.
How much does each receive in a year?
How much more does Charles receive than Katherine in a year?
How much do both together receive in a year?
49. Robert saves and deposits in the savings bank an average of 55 cents a week. How much will he save in a year?
50. The grocer told Mrs. Brown that he could sell her 12 bushels of potatoes at \$1.15 a bushel. If she bought by the peck they would cost her 35 cents a peck. How much can she save on the 12 bushels if she buys by the bushel?

51. Write out a problem in multiplication which you have yourself met and needed to solve.
52. A certain automobile factory turns out 65 new cars each working day. Allowing for 52 Sundays and 8 holidays how many cars will this factory make in a year?
53. If each of these cars sells at \$870 at the factory what does the year's output bring the manufacturer?
54. The Victordale ball nine planned for new equipment. This is the list of what they wanted to buy:

Suits for 12 players	@ \$4.75	
1 doz. caps		\$5.85
3 balls	@ 1.12	
4 bats	@ .65	
1 catcher's mit		2.50
1 catcher's mask		1.85

Tom figured it up and said it would cost \$73.06. Bob figured it and said it would cost \$72.56. Who was right?

Speed and Accuracy Practice in Multiplication

Half the battle in arithmetic is in learning to *concentrate*. This means to think hard and work fast. But be sure you do not make mistakes. Accuracy is more important than speed, but you can be both quick and accurate. Try for a record on this list. Write only the answers.

55.	56.	57.	58.
5948	8190	6849	6598
<u>62</u>	<u>27</u>	<u>239</u>	<u>742</u>

59. 7839 <u>587</u>	60. 9674 <u>459</u>	61. 8976 <u>796</u>	62. 7142 <u>983</u>
63. 1980 <u>72</u>	64. 9638 <u>396</u>	65. 8753 <u>846</u>	66. 8295 <u>873</u>
67. 9154 <u>36</u>	68. 8910 <u>76</u>	69. 7839 <u>68</u>	70. 9358 <u>74</u>
71. 4978 <u>76</u>	72. 9186 <u>96</u>	73. 9836 <u>479</u>	74. 5444 <u>875</u>

Time Test in Multiplication

You should be able to do each of the following tests in the time indicated, with *all products correct*. If you cannot do this your teacher will arrange to give you more practice. Write only the answers.

Test One: 5 minutes

75. 286 <u>72</u>	76. 57 <u>89</u>	77. 75 <u>43</u>	78. 975 <u>61</u>
79. 27 <u>56</u>	80. 631 <u>75</u>	81. 45 <u>93</u>	82. 964 <u>84</u>

Test Two: $5\frac{1}{2}$ minutes

83.	84.	85.	86.
349	458	683	587
<u>15</u>	<u>47</u>	<u>86</u>	<u>92</u>
87.	88.	89.	90.
527	736	468	536
<u>93</u>	<u>58</u>	<u>79</u>	<u>48</u>

Test Three: 6 minutes

91.	92.	93.	94.
123	2674	257	5641
<u>96</u>	<u>63</u>	<u>94</u>	<u>28</u>
95.	96.	97.	98.
9123	8746	8594	572
<u>75</u>	<u>78</u>	<u>67</u>	<u>93</u>

5. Division.

Remember that the four words used in division are:

Dividend:	The number divided.
Divisor:	The number by which you divide.
Quotient:	The number you get by dividing (answer).
Remainder:	The number sometimes left over after you divide.

	$403\frac{5}{12}$	Quotient
Divisor	12)4841	Dividend
	<u>48</u>	
	41	
	<u>36</u>	
	5	Remainder

When we bring down 4 we have a dividend which is smaller than the divisor 12. Place a zero in the quotient over the 4. Next bring down the 1, and go on as usual.

You have noticed that in using long division you have *multiplying* and *subtracting* to do. Strive for skill in these. Work *fast* but be *accurate*.

Divide, giving quotients at sight:

1.	2.	3.	4.
$2\overline{)42}$	$4\overline{)64}$	$9\overline{)72}$	$11\overline{)78}$
5.	6.	7.	8.
$12\overline{)98}$	$12\overline{)85}$	$21\overline{)42}$	$31\overline{)124}$
9.	10.	11.	12.
$41\overline{)205}$	$61\overline{)183}$	$71\overline{)639}$	$81\overline{)567}$
13.	14.	15.	16.
$51\overline{)459}$	$71\overline{)426}$	$31\overline{)155}$	$41\overline{)328}$
17.	18.	19.	20.
$61\overline{)427}$	$91\overline{)637}$	$61\overline{)305}$	$81\overline{)648}$

Divide, using pencil where you need to:

1.	2.	3.	4.
$22\overline{)66}$	$32\overline{)128}$	$42\overline{)378}$	$82\overline{)738}$
5.	6.	7.	8.
$52\overline{)260}$	$62\overline{)5580}$	$72\overline{)3600}$	$92\overline{)7360}$

Divide:

9.	10.	11.	12.
$19\overline{)32}$	$19\overline{)71}$	$19\overline{)124}$	$19\overline{)181}$
13.	14.	15.	16.
$29\overline{)124}$	$29\overline{)152}$	$39\overline{)167}$	$69\overline{)149}$
17.	18.	19.	20.
$79\overline{)247}$	$59\overline{)365}$	$49\overline{)450}$	$89\overline{)728}$

Divide. Work as fast as you can but beware of errors.

21.	22.	23.	24.
$29\overline{)3245}$	$17\overline{)6749}$	$88\overline{)2978}$	$92\overline{)8643}$
25.	26.	27.	28.
$64\overline{)8694}$	$76\overline{)6549}$	$17\overline{)2987}$	$17\overline{)6437}$
29.	30.		
$46\overline{)9432}$	$57\overline{)6947}$		

Problems in Division

31. The distance between Chicago and New York is 978 miles. The Twentieth Century Limited travels this distance in 18 hours. How many miles does it average per hour? *Check your answer.*

32. A man pays \$500 a year rent for a house. How much is this a month? *Prove your result.*
33. A four weeks' camping trip was to cost \$25. Besides this amount the railroad fare would be \$8. George had 12 weeks in which to earn the money to take the trip. How much must he earn each week? *Check the answer.*
34. From the Atlantic coast to the Pacific by air service is 2520 miles. The first complete flight was made in 1923 in about 27 hours. What was the average speed per hour? *Check.*
35. A driver in an automobile race averaged 80 miles an hour. How many hours did he require to cover the distance of 1200 miles? *Check.*
36. If the government at Washington paid \$125,000 for 20 airships, how much did each cost? *Check.*
37. If an ocean liner travels at the rate of 30 miles per hour, how long does it take it to go a distance of 6200 miles? *Check.*
38. The distance from Ogden to Omaha is about 1000 miles. How long will it take an express train at the rate of 45 miles an hour to make the trip? *Check.*
39. Mt. McKinley, the highest mountain in North America, is 20,300 feet high. How many miles high is it? (One mile has 5280 feet.) *Check.*
40. If the food for a family costs \$875 a year, what is the average cost per month? *Check.*
41. The president of the United States receives a salary of \$75,000 per year. What is his salary per month? *Check.*

42. The salary of the vice-president is \$12,000 per year. How much does he receive per month? *Check.*
43. A carrier pigeon covered 660 miles in 12 hours. Find its average rate per hour. *Check.*
44. A flour mill used 21,000 bushels of wheat in 28 working days. Find the average number of bushels used each day. *Check.*
45. A farmer in northern Michigan grew 2700 bushels of potatoes on 15 acres of land. What was the average yield per acre? *Check.*
46. At a college football game, \$60,000 was received for tickets. If there were 24,000 in attendance, what was the average price per ticket? *Check.*
47. A dealer in clothing pays \$2400 for 96 suits. How much does he pay for each suit? *Check.*
48. A farmer sold his 80 acres for \$18,000. How much was that per acre? *Check.*
49. An Iowa farmer sold 48 steers weighing 55,200 pounds. What was the average weight? *Check.*

Divide and check results:

- | | |
|-------------------|-------------------|
| 50. 1710 by 38 | 55. 68,100 by 75 |
| 51. 6104 by 56 | 56. 30,150 by 67 |
| 52. 9400 by 47 | 57. 3900 by 50 |
| 53. 408,770 by 82 | 58. 59,073 by 97 |
| 54. 52,560 by 60 | 59. 324,450 by 70 |

Speed and Accuracy Practice in Division

Speed and accuracy in adding, subtracting, multiplying or dividing come only through practice *with effort*. Do your best on these to get every quotient right. Work fast.

TIMED PRACTICE

60.	61.	62.	63.
$81 \overline{)2704}$	$41 \overline{)7928}$	$82 \overline{)7926}$	$61 \overline{)9437}$
64.	65.	66.	67.
$92 \overline{)8200}$	$73 \overline{)9268}$	$64 \overline{)7943}$	$58 \overline{)9674}$
68.	69.	70.	71.
$29 \overline{)9948}$	$38 \overline{)6749}$	$47 \overline{)2986}$	$93 \overline{)7845}$
72.	73.	74.	75.
$37 \overline{)4368}$	$72 \overline{)9645}$	$17 \overline{)9486}$	$39 \overline{)4976}$
76.	77.	78.	79.
$57 \overline{)9831}$	$75 \overline{)1486}$	$28 \overline{)7986}$	$57 \overline{)9877}$

Time Test in Division

You should become able to find the quotients in the following lists in the time indicated, getting *all correct*. If you cannot do this, practice until you can.

Test One: 7 minutes

80.	81.	82.	83.
$41 \overline{)6784}$	$81 \overline{)4956}$	$61 \overline{)4835}$	$51 \overline{)5470}$
84.	85.	86.	87.
$71 \overline{)8473}$	$91 \overline{)6293}$	$71 \overline{)6891}$	$81 \overline{)5946}$

Test Two: 8 minutes

88.

$$421 \overline{)63942}$$

89.

$$712 \overline{)53874}$$

90.

$$522 \overline{)46831}$$

91.

$$613 \overline{)87494}$$

92.

$$811 \overline{)42735}$$

93.

$$314 \overline{)42826}$$

94.

$$318 \overline{)78943}$$

95.

$$615 \overline{)35946}$$

Test Three: 10 minutes

96.

$$574 \overline{)20774}$$

97.

$$458 \overline{)93632}$$

98.

$$389 \overline{)49826}$$

99.

$$874 \overline{)62408}$$

100.

$$624 \overline{)87459}$$

101.

$$439 \overline{)84729}$$

102.

$$765 \overline{)94327}$$

103.

$$987 \overline{)65943}$$

Write down in your note-book these four words like this:

Addition Subtraction Multiplication Division

Now write down under each of the four words the words from the following list which belong under it: addend; divisor; sum; product; remainder; minuend; quotient; multiplier; dividend; subtrahend; multiplicand.

Exercises

1. *Addition:* In these examples tell the *Addends*. Tell the *Sums*:

56	720	7063
24	31	5265
32	560	8054
<u>112</u>	<u>1311</u>	<u>7321</u>
		27703

2. *Subtraction:* In these examples tell the *Minuend*. Tell the *Subtrahend*. Tell the *Remainder*.

276	569	9062
108	203	5879
<u>168</u>	<u>366</u>	<u>3183</u>

3. *Multiplication:* In these examples tell the *Multiplicand*. Tell the *Multiplier*. Tell the *Product*.

124	726	642
8	13	24
<u>992</u>	<u>2178</u>	<u>2568</u>
	726	1284
	<u>9438</u>	<u>15408</u>

4. *Division:* In these examples tell the *Dividend*. Tell the *Divisor*. Tell the *Quotient*. Tell the *Remainder*.

$59\frac{1}{11}$	$84\frac{7}{9}$	$1709\frac{2}{15}$
11)659	9)763	15)25644
55	72	15
<u>109</u>	<u>43</u>	<u>106</u>
99	36	105
<u>10</u>	<u>7</u>	<u>144</u>
		135
		<u>9</u>

II. FRACTIONS: REDUCTION, ADDITION AND SUBTRACTION

1. Changing Fractions to Whole or Mixed Numbers, and Whole or Mixed Numbers to Fractions.

Joe said to his mother one evening, "Why must we have fractions in arithmetic?" His mother answered, "We must have fractions in arithmetic because we have fractions in our homes, in our stores, on our farms, and even on the playground." Joe did not quite understand, so asked his mother to explain.



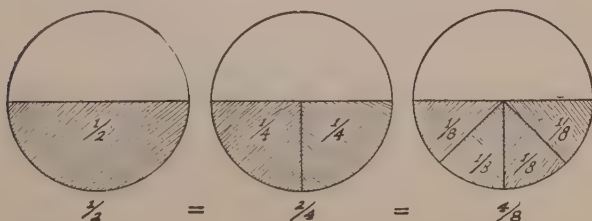
"Into how many pieces do you like a pie to be cut?" asked his mother. "Oh, about 4," said Joe. "Then what fraction of the whole pie would you get?" his mother inquired. "I would get $\frac{1}{4}$, unless I could have two pieces, then I would get $\frac{1}{2}$," grinned Joe. "So it must be that $\frac{2}{4}$ of a pie is the same as $\frac{1}{2}$ of the pie?" asked his mother. Joe agreed.

"So you see you can't even cut a pie without fractions," said Joe's mother. "Without fractions you could not buy a half-pound of candy or keep track of your athletic records." Then she added, "Now I am going to write down some everyday problems in fractions for you to solve." These are the questions she asked Joe to answer. See whether you can answer them.

1. You have two apples you want to divide equally among 8 boys. What part of an apple does each boy get?
2. A grocer has a 4-pound can of tea that he wants to put up in $\frac{1}{4}$ -pound packages. How many packages will he have?
3. The school has a $\frac{1}{2}$ -mile running track. How many laps must the runner make in a 2-mile race?
4. How many quarters in change will the bank give you for a 2-dollar bill?
5. How many pint bottles will it take to hold a gallon of milk? What fraction of a gallon is a pint?
6. At a party where there were 9 girls they wanted to play a game that required each girl to have a pencil. They had but 3 pencils. Into how many parts must they cut each pencil in order to supply all the girls? What fraction of a pencil did each girl receive? How many $\frac{1}{3}$'s in 1? How many $\frac{1}{3}$'s in 3?

7. How many pies will be required to serve 24 persons if each pie is cut into 6 pieces? What part of a pie will each person receive? How many $\frac{1}{6}$'s in 1? How many $\frac{1}{6}$'s in 4?
8. If you have a yard-stick how many 1-foot rulers can you cut from it? How many feet in 1 yard? What fraction of a yard is 1 foot?
9. A restaurant keeper had 25 pies. He could cut the pies into quarters and sell the pieces at 15¢ each, or into sixths and sell them at 10¢ each. Which plan would make the more profit, and how much more?
10. How much would he receive if he cut the pies into fifths and sold the pieces at 12¢ each?

In each of the three circles the lower $\frac{1}{2}$ is shaded. In the second circle how many *fourths* are in the shaded half? In the third circle how many *eighths* in the shaded half? How many fourths make $\frac{1}{2}$? How many eighths make $\frac{1}{4}$? How many eighths make $\frac{1}{2}$?



Compare the following three rectangles. How many *halves* in the first? How many *fourths* in the second? How many *eighths* in the third?



How many *fourths* equal $\frac{1}{2}$?

How many *eighths* equal $\frac{1}{2}$?

How many *eighths* equal $\frac{1}{4}$?

How many *fourths* equal $\frac{2}{2}$, or the whole?

How many *eighths* equal $\frac{4}{4}$, or the whole?

How many *eighths* equal $\frac{3}{4}$?

Take a rectangular piece of paper and fold it to show *halves*.

Then fold the same sheet again and make it show *fourths*. How many fourths in each half? $\frac{1}{2} = \frac{2}{4}$. Once more, fold the same sheet to show *eighths*. How many eighths in each *half*? $\frac{1}{4} = \frac{2}{8}$. $\frac{1}{2} = \frac{4}{8}$.

Think of still other ways in which you can show that $\frac{1}{2} = \frac{2}{4} = \frac{4}{8}$.

Think of ways in which you can show that $1 = \frac{3}{3} = \frac{6}{6}$.

Think of ways in which you can show that $\frac{1}{2} = \frac{3}{6}$.

When anything is divided into 2 equal parts we write one of the parts $\frac{1}{2}$. If anything is divided into 3 equal parts we write each of the parts $\frac{1}{3}$. If anything is divided into 4 equal parts we write each of the parts $\frac{1}{4}$.

Write as many fractions as you can in two minutes, and be able to tell for each fraction the number of parts into which the whole is divided, and how many parts are taken.

A fraction is one or more equal parts of a whole thing.

The lower number is the *denominator*. The denominator *names* the fraction and shows into *how many* equal parts the whole is divided. In the fraction $\frac{3}{4}$, the denominator 4 shows that the whole is divided into four equal parts.

The upper number is the *numerator*. The numerator shows the number of equal parts of the whole taken. In the fraction $\frac{3}{4}$ the numerator 3 shows that three parts are taken.

In the following fractions which part of the compound word **names** the fraction? Which part shows the **number** of equal parts of the whole taken?

one-fourth

two-thirds

five-sixths

three-fourths

seven-eighths

nine-nineteenths

two-fifths

eleven-twentieths

nine-sixteenths

two-seventeenths.

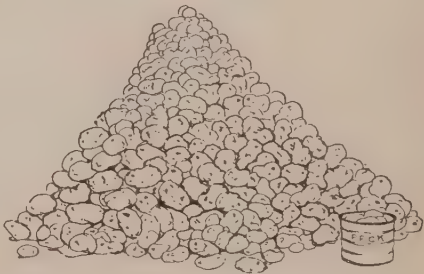
1. Write the fractions in figures.
2. Think of other fractions and write as many as you can in 1 minute.

Problems

1. Harold is errand boy in an office. His employer told him to go to the bank and change a five-dollar bill into dimes. How many dimes did Harold receive from the bank?

How many dimes in 1 dollar? What fraction of 1 dollar is a dime?

2. Another day Harold was asked to go to the bank with a ten-dollar bill and have it changed into quarters. How many quarters did he receive? How many quarters in 1 dollar? What fraction of 1 dollar is a quarter?
3. How many nickels ought you to receive in exchange for a five-dollar bill? For a ten-dollar bill?
4. John helped his father dig potatoes. He used a peck measure to put the potatoes in. In one day he picked up and put in a pile 86 pecks. To take the potatoes to market they put them in boxes each of which held 1 bushel. How many boxes will hold John's potatoes?



5. The fifth-grade class had 30 pupils. They were to have a picnic, and Mary and Henry were to plan the lunch. At the beginning of the lunch each boy and girl was to be served $\frac{1}{2}$ of an orange. For dessert they were to have apple pie. Each person was to have $\frac{1}{6}$ of a pie.
 - a. How many oranges would be required?
 - b. How many pies would be required?
6. Walter works 8 hours of every day of the week except Sunday.
 - a. What fraction of each day (24 hours) does he work?

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8 hours = $\frac{8}{24}$ or $\frac{1}{3}$ of 1 day, the fraction that Walter works.

- b. What fraction of the week does he work?

In 6 days Walter works $6 \times \frac{1}{3}$ of 1 day, or $\frac{6}{3}$ days. $\frac{6}{3} = 2$. Therefore in 1 week Walter works 2 days of 24 hours each. The fraction of 6 days that he works is therefore $\frac{2}{6}$ or $\frac{1}{3}$.

7. In every 24 hours James spends 5 hours at school, 3 hours in working at home, 2 hours at meals, 10 hours sleeping and 4 hours playing. What fraction of the day does he spend in school? At work? In sleep? At play?
8. In one month of school (20 days), how many days does James spend at meals? In sleep? At school? At play? At work?
9. Roger goes to church every Sunday for 2 hours. What fraction of a day does he spend at church?

Change to halves:

1. 4 = ____ halves.
2. 6 = ____ halves.
3. 5 = ____ halves.
4. 8 = ____ halves.
5. 10 = ____ halves.
6. 12 = ____ halves.
7. 9 = ____ halves.
8. 15 = ____ halves.
9. 7 = ____ halves.
10. 11 = ____ halves.

Change to fifths:

1. 2 = ____ fifths.
2. 7 = ____ fifths.
3. 4 = ____ fifths.
4. 5 = ____ fifths.
5. 3 = ____ fifths.
6. 11 = ____ fifths.
7. 6 = ____ fifths.
8. 15 = ____ fifths.
9. 8 = ____ fifths.
10. 9 = ____ fifths.

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Change to fourths:

1. $10 = \underline{\hspace{1cm}}$ fourths.
2. $3 = \underline{\hspace{1cm}}$ fourths.
3. $11 = \underline{\hspace{1cm}}$ fourths.
4. $6 = \underline{\hspace{1cm}}$ fourths.
5. $4 = \underline{\hspace{1cm}}$ fourths.

6. $7 = \underline{\hspace{1cm}}$ fourths.
7. $5 = \underline{\hspace{1cm}}$ fourths.
8. $12 = \underline{\hspace{1cm}}$ fourths.
9. $15 = \underline{\hspace{1cm}}$ fourths.
10. $13 = \underline{\hspace{1cm}}$ fourths.

Change to thirds:

1. $7 = \underline{\hspace{1cm}}$ thirds.
2. $12 = \underline{\hspace{1cm}}$ thirds.
3. $5 = \underline{\hspace{1cm}}$ thirds.
4. $8 = \underline{\hspace{1cm}}$ thirds.
5. $13 = \underline{\hspace{1cm}}$ thirds.

6. $10 = \underline{\hspace{1cm}}$ thirds.
7. $20 = \underline{\hspace{1cm}}$ thirds.
8. $16 = \underline{\hspace{1cm}}$ thirds.
9. $2 = \underline{\hspace{1cm}}$ thirds.
10. $15 = \underline{\hspace{1cm}}$ thirds.

Change to sixths:

1. $6 = \underline{\hspace{1cm}}$ sixths.
2. $9 = \underline{\hspace{1cm}}$ sixths.
3. $11 = \underline{\hspace{1cm}}$ sixths.
4. $3 = \underline{\hspace{1cm}}$ sixths.
5. $15 = \underline{\hspace{1cm}}$ sixths.

6. $7 = \underline{\hspace{1cm}}$ sixths.
7. $8 = \underline{\hspace{1cm}}$ sixths.
8. $12 = \underline{\hspace{1cm}}$ sixths.
9. $10 = \underline{\hspace{1cm}}$ sixths.
10. $14 = \underline{\hspace{1cm}}$ sixths.

Change to eighths:

1. $9 = \underline{\hspace{1cm}}$ eighths.
2. $3 = \underline{\hspace{1cm}}$ eighths.
3. $7 = \underline{\hspace{1cm}}$ eighths.
4. $12 = \underline{\hspace{1cm}}$ eighths.
5. $8 = \underline{\hspace{1cm}}$ eighths.

6. $13 = \underline{\hspace{1cm}}$ eighths.
7. $10 = \underline{\hspace{1cm}}$ eighths.
8. $15 = \underline{\hspace{1cm}}$ eighths.
9. $6 = \underline{\hspace{1cm}}$ eighths.
10. $5 = \underline{\hspace{1cm}}$ eighths.

Change to sevenths:

- | | |
|------------------------|------------------------|
| 1. 4 = ____ sevenths. | 6. 9 = ____ sevenths. |
| 2. 3 = ____ sevenths. | 7. 8 = ____ sevenths. |
| 3. 10 = ____ sevenths. | 8. 11 = ____ sevenths. |
| 4. 5 = ____ sevenths. | 9. 7 = ____ sevenths. |
| 5. 12 = ____ sevenths. | 10. 6 = ____ sevenths. |

Remember these facts which you learned in BOOK ONE:

A *proper* fraction is a fraction whose numerator is smaller than its denominator. As $\frac{2}{3}$, $\frac{4}{9}$, $\frac{5}{12}$.

An *improper* fraction is a fraction whose numerator is equal to or is larger than its denominator. As $\frac{2}{2}$, $\frac{12}{3}$, $\frac{24}{4}$.

A *mixed* number is a number made up of a whole number and a fraction. As $5\frac{1}{2}$, $9\frac{2}{3}$, or $14\frac{3}{5}$.

John milked a cow that gave a 10-quart pail full of milk. How many gallons did the cow give?

Since 4 quarts make 1 gallon, we can say that the cow gave $\frac{10}{4}$ gallons of milk.

We have already learned that $\frac{10}{4}$ means $10 \div 4$. Therefore $\frac{10}{4} = 2\frac{1}{2}$, and John's cow gave $2\frac{1}{2}$ gallons of milk.

To change an improper fraction to a whole number or to a mixed number, divide the numerator by the denominator.

Change to whole or mixed numbers:

- | | | |
|---------------|----------------|----------------|
| 1. 24 halves | 5. 25 fifths | 9. 23 sevenths |
| 2. 17 thirds | 6. 72 eighths | 10. 44 fourths |
| 3. 19 fourths | 7. 34 sevenths | 11. 51 eighths |
| 4. 20 sixths | 8. 15 halves | 12. 72 sixths |

Change to whole or mixed numbers:

13. $\frac{20}{3}$

17. $\frac{29}{4}$

21. $\frac{144}{2}$

25. $\frac{84}{12}$

14. $\frac{36}{8}$

18. $\frac{37}{9}$

22. $\frac{90}{3}$

26. $\frac{168}{8}$

15. $\frac{48}{16}$

19. $\frac{200}{5}$

23. $\frac{77}{7}$

27. $\frac{79}{6}$

16. $\frac{100}{7}$

20. $\frac{85}{3}$

24. $\frac{100}{4}$

28. $\frac{38}{5}$

29. 80 minutes or $\frac{80}{60}$ hours, to hours

30. 30 days, or $\frac{30}{7}$ weeks, to weeks

31. 29 feet, or $\frac{29}{3}$ yards, to yards

32. 15 inches, or $\frac{15}{12}$ feet, to feet

33. 20 ounces, or $\frac{20}{16}$ pounds, to pounds

34. $\frac{120}{60}$ minutes to hours

35. $\frac{8}{2}$ quarts to quarts

36. $\frac{47}{16}$ pounds to pounds

37. $\frac{17}{4}$ gallons to gallons

38. $\frac{12}{4}$ bushels to bushels

39. $\frac{36}{24}$ days to days

40. $\frac{24}{16}$ pounds to pounds

41. $\frac{15}{4}$ gallons to gallons

42. $\frac{18}{12}$ feet to feet

43. $\frac{17}{3}$ yards to yards

44. $\frac{23}{2}$ quarts to quarts

45. $\frac{35}{16}$ pounds to pounds

46. $\frac{23}{4}$ gallons to gallons

47. $\frac{240}{60}$ hours to hours

48. $\frac{72}{24}$ days to days

See whether you can answer these questions:

1. Why are such fractions as $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$ called *proper fractions*?
2. Why are such fractions as $\frac{14}{3}$, $\frac{16}{4}$, $\frac{23}{8}$ called *improper fractions*?
3. Why are such numbers as $7\frac{1}{3}$, $5\frac{3}{8}$, $9\frac{2}{11}$ called *mixed numbers*?

Jennie's mother had company and was serving each person $\frac{1}{2}$ of a grapefruit at breakfast. She had $4\frac{1}{2}$ grapefruit. How many persons could she serve?

In 1 grapefruit there are 2 halves. In 4 grapefruit there are 4×2 or 8 halves. 8 halves + 1 half = 9 halves.
Therefore she could serve 9 persons.

1. How many fourths are $3\frac{1}{4}$?
2. How many sixths are $2\frac{5}{6}$?
3. How many halves in $5\frac{1}{2}$?
4. How many eighths are $4\frac{3}{8}$?
5. How many fifths are $6\frac{2}{5}$?
6. How many ninths are $5\frac{4}{9}$?

How is an improper fraction changed to a *whole* or a *mixed number*?

To change a mixed number into an improper fraction, multiply the whole number by the denominator, and add the result to the numerator of the fraction.

Change each of the following mixed numbers to improper fractions:

52 CHANGING MIXED NUMBERS TO FRACTIONS

- | | |
|--------------------------------|----------------------------------|
| 1. $4\frac{1}{3}$ to thirds | 11. $15\frac{1}{2}$ to halves |
| 2. $2\frac{4}{5}$ to fifths | 12. $12\frac{1}{4}$ to fourths |
| 3. $3\frac{3}{4}$ to fourths | 13. $3\frac{1}{6}$ to sixteenths |
| 4. $4\frac{3}{5}$ to fifths | 14. $11\frac{2}{3}$ to thirds |
| 5. $3\frac{1}{8}$ to eighths | 15. $4\frac{5}{7}$ to sevenths |
| 6. $7\frac{1}{2}$ to halves | 16. $8\frac{2}{3}$ to thirds |
| 7. $7\frac{1}{6}$ to sixths | 17. $7\frac{3}{4}$ to fourths |
| 8. $8\frac{5}{8}$ to eighths | 18. $9\frac{1}{2}$ to halves |
| 9. $3\frac{2}{9}$ to ninths | 19. $5\frac{2}{5}$ to fifths |
| 10. $5\frac{4}{7}$ to sevenths | 20. $10\frac{9}{10}$ to tenths |

Change to improper fractions:

- | | | |
|---------------------|-------------------------------|----------------------|
| 21. $7\frac{1}{3}$ | 28. $6\frac{3}{4}$ | 35. $15\frac{3}{5}$ |
| 22. $8\frac{4}{5}$ | 29. $7\frac{5}{6}$ | 36. $30\frac{1}{7}$ |
| 23. $9\frac{7}{8}$ | 30. $13\frac{1}{2}$ | 37. $12\frac{3}{5}$ |
| 24. $12\frac{5}{9}$ | 31. $20\frac{1}{3}$ | 38. $22\frac{3}{4}$ |
| 25. $7\frac{6}{8}$ | 32. $5\frac{1\frac{1}{2}}{2}$ | 39. $8\frac{4}{7}$ |
| 26. $8\frac{1}{8}$ | 33. $9\frac{3}{7}$ | 40. $10\frac{1}{10}$ |
| 27. $4\frac{9}{11}$ | 34. $25\frac{1}{4}$ | 41. $14\frac{5}{6}$ |

Problems

- Write two-fifths in figures.
- Mary had a yard of ribbon and used 1 foot of it. What part of the yard did she use?
- Dick had 75 cents and spent 25 cents. What fractional part of the 75 cents did he have left?

4. Elsie wants to divide an apple so as to keep $\frac{1}{4}$ of it. How should she divide it?
5. Sam counted six halves of oranges on the breakfast table. How many whole oranges were used?
6. Sam jumped $1\frac{2}{4}$ feet. How many feet did he jump?
7. A troupe of Boy Scouts hiked $3\frac{1}{4}$ miles. How many quarter, that is $\frac{1}{4}$, miles did they go?
8. Another troop picked 20 quarts of wild berries. How many gallons did they pick?
9. Each of 35 children bought a pint of milk. How many gallons did they buy?
10. John says that 25 pieces of pie can be cut from $6\frac{1}{4}$ pies if each pie is cut into fourths. Is he right?
11. Roger eats half an apple each morning at breakfast. How many apples does he eat at breakfast in 13 days?

2. Addition of Fractions.

1. One room has 5 chairs, and another has 7. How many chairs in the two rooms?
2. In my purse I have 30 cents, and in my hand I have 15 cents. How many cents have I altogether?
3. In my right hand I have $\frac{1}{4}$ of a dollar, and in my left hand $\frac{2}{4}$ of a dollar. How many fourths of a dollar have I in both hands?
4. In a relay race Henry, George, John and Tom each ran $\frac{1}{8}$ of a mile. How far did they all run?

$$\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{4}{8}.$$

Therefore they all ran $\frac{4}{8}$ of a mile.

5. In another race Joe ran $\frac{1}{8}$ of a mile and Robert $\frac{1}{5}$ of a mile. How far did they both run?

$$\frac{1}{8} + \frac{1}{5} = ?$$

We cannot add the numerators of these fractions as we did in the problem four, for this would be something like trying to add 3 boys and 2 girls. We cannot add boys and girls unless we call them all *children*. We cannot add one fraction to another unless their denominators are the same.

Fractions whose denominators are the same are called **similar fractions**. As $\frac{1}{4}$, $\frac{3}{4}$.

Fractions whose denominators are not the same are called **dissimilar fractions**. As $\frac{2}{3}$, $\frac{3}{5}$.

Only similar fractions can be added. Before we can add fractions their denominators must be the same.

When the denominators of fractions are the same they are said to have *common denominators*.

Below are five sets of fractions. From each set pick out the ones that are similar and write them together. For example; in the first group $\frac{1}{6}$ and $\frac{2}{6}$ are similar. See what other similar fractions you can find in the first group, and so on with each of the other groups.

1. $\frac{1}{6}$, $\frac{1}{2}$, $\frac{2}{3}$, $\frac{2}{6}$, $\frac{4}{5}$, $\frac{3}{4}$, $\frac{2}{5}$, $\frac{1}{4}$.

2. $\frac{5}{6}$, $\frac{2}{7}$, $\frac{3}{8}$, $\frac{5}{7}$, $\frac{4}{16}$, $\frac{5}{8}$, $\frac{4}{21}$, $\frac{9}{11}$.

3. $\frac{4}{25}$, $\frac{11}{32}$, $\frac{8}{17}$, $\frac{4}{15}$, $\frac{9}{32}$, $\frac{4}{29}$, $\frac{2}{25}$, $\frac{8}{17}$.

4. $\frac{1}{100}$, $\frac{4}{69}$, $\frac{5}{56}$, $\frac{11}{14}$, $\frac{15}{119}$, $\frac{51}{69}$, $\frac{99}{100}$, $\frac{78}{79}$.

5. $\frac{15}{95}$, $\frac{4}{15}$, $\frac{2}{3}$, $\frac{11}{19}$, $\frac{47}{48}$, $\frac{54}{56}$, $\frac{6}{15}$, $\frac{1}{95}$.

State the sums of these similar fractions without using pencil:

6. $\frac{1}{4}$ $\frac{1}{4}$ 	7. $\frac{2}{3}$ $\frac{1}{3}$ 	8. $\frac{2}{5}$ $\frac{3}{5}$ 	9. $\frac{3}{7}$ $\frac{5}{7}$ 	10. $\frac{5}{6}$ $\frac{5}{6}$ 	11. $\frac{3}{8}$ $\frac{7}{8}$
12. $\frac{2}{9}$ $\frac{7}{9}$ 	13. $\frac{3}{4}$ $\frac{1}{4}$ 	14. $\frac{4}{5}$ $\frac{3}{5}$ 	15. $\frac{1}{6}$ $\frac{2}{6}$ $\frac{5}{6}$ 	16. $\frac{3}{7}$ $\frac{2}{7}$ $\frac{6}{7}$ 	17. $\frac{2}{9}$ $\frac{3}{9}$ $\frac{4}{9}$
18. $\frac{3}{7}$ $\frac{5}{7}$ $\frac{4}{7}$ 	19. $\frac{3}{8}$ $\frac{6}{8}$ $\frac{7}{8}$ 	20. $\frac{2}{7}$ $\frac{3}{7}$ $\frac{5}{7}$ 	21. $\frac{3}{4}$ $\frac{1}{4}$ $\frac{3}{4}$ 	22. $\frac{5}{9}$ $\frac{4}{9}$ $\frac{7}{9}$ 	23. $\frac{5}{6}$ $\frac{1}{6}$ $\frac{5}{6}$

In two weeks Harry's baby brother gained $\frac{1}{2}$ of a pound in weight and the next two weeks $\frac{3}{4}$ of a pound. How many pounds did he gain in the four weeks?

$$\frac{1}{2} \text{ lb.} + \frac{3}{4} \text{ lb.} = ?$$

We cannot add $\frac{1}{2}$ and $\frac{3}{4}$ because they are dissimilar fractions. So we change $\frac{1}{2}$ to fourths. $\frac{1}{2} = \frac{2}{4}$. Now we can say:

$$\frac{2}{4} + \frac{3}{4} = \frac{5}{4}.$$

$$\frac{5}{4} = 1\frac{1}{4}.$$

Therefore the baby gained $1\frac{1}{4}$ pounds in four weeks.

On a morning after a rain, George measured the water in a pail that had stood outdoors. It was $1\frac{1}{4}$ inches deep.

He emptied the pail and the next morning after another rain found $\frac{3}{8}$ inches of water in it. How many inches had it rained in the two nights?

$$1\frac{1}{4} \text{ in.} + \frac{3}{8} \text{ in.} = ?$$

First change $\frac{1}{4}$ to eighths. $\frac{1}{4} = \frac{2}{8}$.

$$1\frac{2}{8} + \frac{3}{8} = 1\frac{5}{8}$$

Therefore it rained $1\frac{5}{8}$ inches in the two nights.

Jane's mother asked her to look in the ice-box and see whether there was pie enough for dessert. Jane found 3 half-pies. How many could be served if each had $\frac{1}{6}$ of a pie?

$$\frac{3}{2} = \frac{?}{6}$$

Since each half-pie is the same as 3 sixths of a pie, 3 half-pies will make 9 sixths of a pie.

$$\frac{3}{2} \times \frac{3}{3} = \frac{9}{6}.$$

To change to similar fractions when one denominator can be divided by the other denominator without a remainder:

First, divide the larger denominator by the smaller.

Then, multiply both numerator and denominator of the fraction having the smaller denominator by the quotient.

For example, suppose we want to change $\frac{3}{4}$ and $\frac{5}{12}$ to similar fractions. The larger denominator, 12, can be divided by the smaller denominator, 4, without a remainder.

$$12 \div 4 = 3.$$

$$\frac{3}{4} \times \frac{3}{3} = \frac{9}{12}.$$

So we can write the fractions as $\frac{9}{12}$ and $\frac{5}{12}$. These are similar fractions.

Can you add $\frac{3}{4}$ and $\frac{5}{12}$?

Can you add $\frac{9}{12}$ and $\frac{5}{12}$?

1. Find the sums of these dissimilar fractions. Before adding, rewrite them, changing them to similar fractions.

A.	B.	C.	D.	E.	F.
$\frac{1}{2}$	$\frac{1}{3}$	$\frac{2}{5}$	$\frac{3}{4}$	$\frac{2}{3}$	$\frac{1}{4}$
<u>$\frac{3}{4}$</u>	<u>$\frac{5}{6}$</u>	<u>$\frac{3}{10}$</u>	<u>$\frac{7}{8}$</u>	<u>$\frac{1}{6}$</u>	<u>$\frac{5}{8}$</u>

G.	H.	I.	J.	K.	L.
$\frac{1}{2}$	$\frac{3}{5}$	$\frac{5}{9}$	$\frac{3}{8}$	$\frac{5}{6}$	$\frac{1}{4}$
<u>$\frac{7}{8}$</u>	<u>$\frac{7}{10}$</u>	<u>$\frac{1}{18}$</u>	<u>$\frac{1}{2}$</u>	<u>$\frac{3}{12}$</u>	<u>$\frac{7}{12}$</u>

M.	N.	O.	P.	Q.	R.
$\frac{1}{6}$	$\frac{7}{16}$	$\frac{5}{12}$	$\frac{5}{6}$	$\frac{9}{4}$	$\frac{5}{8}$
<u>$\frac{1}{2}$</u>	<u>$\frac{3}{4}$</u>	<u>$\frac{1}{6}$</u>	<u>$\frac{7}{18}$</u>	<u>$\frac{1}{2}$</u>	<u>$\frac{1}{2}$</u>

If the numerator and denominator of a fraction are divided by the same number the value of the fraction is not changed.

2. Change $\frac{1}{4}$ and $\frac{6}{8}$ to similar fractions.
First change $\frac{6}{8}$ to fourths.

$$\frac{6}{8} \div \frac{2}{2} = \frac{3}{4}$$

We can now write the fractions $\frac{1}{4}$ and $\frac{3}{4}$.

Dividing the numerator and denominator of a fraction by the same number is called **reducing the fraction to lower terms**.

3. Change to similar fractions by reducing to lower terms the fractions having the larger denominators.
Then find the sums:

a. $\frac{1}{2} + \frac{2}{4}$

b. $\frac{6}{8} + \frac{3}{4}$

c. $\frac{4}{5} + \frac{8}{10}$

d. $\frac{2}{6} + \frac{1}{3}$

e. $\frac{7}{8} + \frac{10}{16}$

f. $\frac{5}{6} + \frac{2}{12}$

g. $\frac{3}{5} + \frac{8}{20}$

h. $\frac{4}{8} + \frac{1}{4}$

i. $\frac{6}{9} + \frac{1}{3}$

j. $\frac{8}{12} + \frac{2}{3}$

k. $\frac{7}{10} + \frac{12}{20}$

l. $\frac{9}{15} + \frac{1}{5}$

m. $\frac{9}{21} + \frac{2}{7}$

n. $\frac{8}{24} + \frac{1}{6}$

o. $\frac{12}{18} + \frac{2}{9}$

4. Lucy needed ribbon for trimming her doll's dress. She bought $\frac{2}{3}$ of a yard of blue and $\frac{1}{4}$ of a yard of pink. How much of both colors did she buy?

$$\frac{2}{3} \times \frac{4}{4} = \frac{8}{12}$$

$$\frac{1}{4} \times \frac{3}{3} = \frac{3}{12}$$

12 is the smallest number that will contain both denominators, 3 and 4, without a remainder. 12 is called the *least common denominator* of the two fractions.

$$\frac{8}{12} + \frac{3}{12} = \frac{11}{12}$$

Therefore Lucy bought $\frac{11}{12}$ of a yard of ribbon.

Problems

1. James found a job at \$1.50 a day for the summer vacation. It was agreed that on days when there was not much work he would work on part time and receive pay only for the fraction of the day he put in. This is the record of the time he worked the first week:

Monday..... $\frac{1}{2}$ day

Tuesday.....1 day

Wednesday..... $\frac{3}{8}$ day

Thursday..... $\frac{1}{8}$ day

Friday..... $\frac{3}{4}$ day

Saturday..... $\frac{1}{4}$ day

How many days did James work the first week?

2. The record of his time the second week was as follows:

Monday..... $\frac{2}{3}$ day
 Tuesday..... $\frac{3}{4}$ day
 Wednesday..... $\frac{5}{8}$ day
 Thursday..... $\frac{1}{2}$ day
 Friday..... $\frac{1}{3}$ day
 Saturday..... $\frac{1}{4}$ day

How many days did he work the second week?

The different denominators of the fractions are 2, 3, 4, 6. Since 12 is the least number that will contain all these numbers without a remainder, we can rewrite the fractions in this way before adding:

$$\begin{array}{lll} \frac{2}{3} = \frac{8}{12} & \frac{5}{6} = \frac{10}{12} & \frac{1}{3} = \frac{4}{12} \\ \frac{3}{4} = \frac{9}{12} & \frac{1}{2} = \frac{6}{12} & \frac{1}{4} = \frac{3}{12} \end{array}$$

3. Alice, Mary and Elizabeth were to have new dresses. Alice needed $5\frac{2}{3}$ yards of material, Mary $7\frac{1}{6}$ yards and Elizabeth $6\frac{1}{4}$ yards. How many yards were required in all?

$$5\frac{2}{3} = 5\frac{8}{12}$$

$$7\frac{1}{6} = 7\frac{2}{12}$$

$$6\frac{1}{4} = 6\frac{3}{12}$$

$$19\frac{13}{12}$$

It is convenient to rewrite the numbers, using 12 as the least common denominator. Adding the twelfths gives $\frac{13}{12}$ or $1\frac{1}{12}$. Add the 1 to the whole numbers.

4. A troop of Camp Fire Girls took a hike each week. One week they went $5\frac{1}{2}$ miles, another week $6\frac{1}{4}$ miles and another $4\frac{3}{4}$ miles. How far did they hike in the three weeks?
5. George raised $12\frac{3}{4}$ bushels of potatoes, John raised $15\frac{1}{2}$ and Frank raised $14\frac{1}{3}$. How many bushels did they all raise?

6. In December it snowed $7\frac{3}{8}$ inches, in January $8\frac{1}{2}$ inches, in February $6\frac{3}{4}$ inches and in March $5\frac{1}{4}$ inches. How many inches of snow fell in these four months?
7. Bob caught four fish whose weights were $2\frac{3}{4}$ pounds, $1\frac{3}{8}$ pounds, $4\frac{1}{2}$ pounds and $3\frac{3}{4}$ pounds. What was the weight of all four fish?
8. Jessie sold four turkeys. The weights of them were $10\frac{3}{4}$ pounds, $13\frac{5}{8}$ pounds, $12\frac{1}{2}$ pounds and $16\frac{7}{8}$ pounds. How much did they all weigh?
9. A family spends $\frac{3}{16}$ of their income for rent, $\frac{3}{8}$ for food, $\frac{3}{16}$ for clothes and $\frac{1}{4}$ for incidentals. What part of the income is left?
10. A room is $14\frac{1}{2}$ feet long and $13\frac{1}{3}$ feet wide. What is the combined length in feet of both ends and both sides?

Find the sums of the following dissimilar fractions:

1.	2.	3.	4.	5.	6.
$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{5}$	$\frac{2}{3}$	$\frac{3}{5}$	$\frac{5}{6}$
$\frac{1}{3}$	$\frac{1}{4}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{2}{3}$	$\frac{6}{7}$
7.	8.	9.	10.	11.	12.
$\frac{3}{5}$	$\frac{2}{3}$	$\frac{4}{5}$	$\frac{2}{5}$	$\frac{1}{4}$	$\frac{5}{6}$
$\frac{5}{8}$	$\frac{3}{8}$	$\frac{5}{6}$	$\frac{3}{8}$	$\frac{1}{6}$	$\frac{2}{9}$
13.	14.	15.	16.	17.	18.
$\frac{5}{6}$	$\frac{3}{8}$	$\frac{3}{4}$	$\frac{3}{10}$	$\frac{3}{8}$	$\frac{9}{10}$
$\frac{7}{8}$	$\frac{3}{10}$	$\frac{7}{10}$	$\frac{5}{6}$	$\frac{5}{6}$	$\frac{3}{4}$

19.	20.	21.	22.	23.	24.
$\frac{7}{10}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{1}{6}$	$\frac{5}{8}$	$\frac{7}{10}$
$\frac{4}{5}$	$\frac{7}{12}$	$\frac{5}{6}$	$\frac{7}{9}$	$\frac{7}{10}$	$\frac{1}{6}$

25.	26.	27.	28.	29.	30.
			$\frac{2}{5}$		$\frac{5}{6}$
$\frac{5}{6}$	$\frac{7}{8}$	$\frac{2}{7}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{1}{4}$
$\frac{2}{9}$	$\frac{7}{10}$	$\frac{6}{8}$	$\frac{3}{10}$	$\frac{4}{5}$	$\frac{5}{12}$

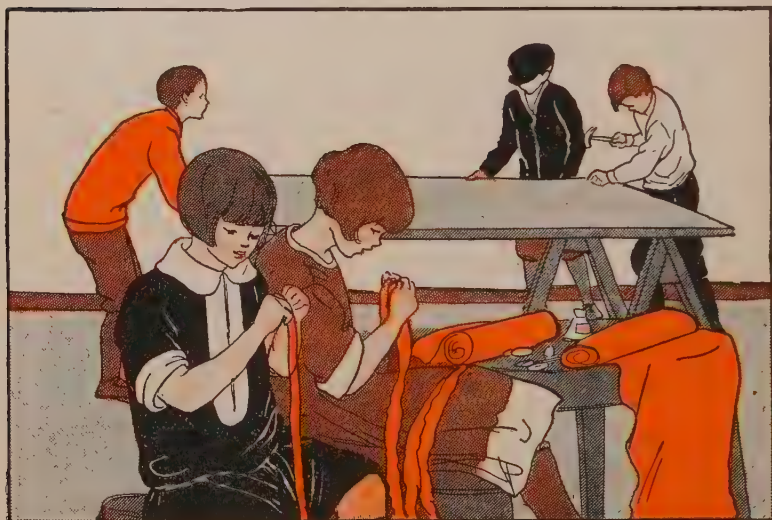
31.	32.	33.	34.	35.	36.
$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{3}$			
$\frac{1}{4}$	$\frac{1}{2}$	$\frac{5}{7}$	$\frac{7}{8}$	$\frac{2}{5}$	$\frac{5}{6}$
$\frac{13}{16}$	$\frac{5}{6}$	$\frac{5}{12}$	$\frac{5}{6}$	$\frac{5}{9}$	$\frac{7}{16}$

37.	38.	39.	40.	41.	42.
$\frac{1}{4}$	$\frac{2}{5}$	$\frac{1}{6}$	$\frac{6}{7}$	$\frac{1}{4}$	$\frac{2}{5}$
$\frac{1}{3}$	$\frac{1}{9}$	$\frac{4}{5}$	$\frac{2}{3}$	$\frac{1}{5}$	$\frac{1}{7}$
$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{6}$	$\frac{1}{2}$
$\frac{1}{5}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{4}$

43.	44.	45.	46.	47.	48.
$\frac{1}{8}$	$\frac{5}{12}$	$\frac{1}{16}$	$\frac{1}{12}$	$\frac{2}{9}$	$\frac{3}{14}$
$\frac{1}{9}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{2}{18}$	$\frac{2}{21}$
$\frac{1}{2}$	$\frac{2}{3}$	$\frac{1}{5}$	$\frac{1}{8}$	$\frac{1}{6}$	$\frac{3}{7}$
$\frac{1}{4}$	$\frac{1}{9}$	$\frac{1}{6}$	$\frac{1}{4}$	$\frac{2}{3}$	$\frac{1}{6}$

The School Bazaar

1. The fifth grade planned to have a bazaar. The boys nailed boards together for table tops. Each table top was made of three boards. The first board was $12\frac{1}{2}$ inches wide, the second one $9\frac{5}{8}$ inches wide, and the third $11\frac{3}{4}$ inches wide. How wide was each table top?



2. The girls decorated the tables with crêpe paper. Mary cut $3\frac{1}{3}$ yards of crêpe, Alice $5\frac{1}{2}$ yards and Jane $4\frac{3}{4}$ yards. How many yards of crêpe did they cut?
3. Nancy made a cap and an apron to match. For the apron she used $1\frac{7}{8}$ yards and for the cap $\frac{1}{4}$ of a yard. How many yards in both?

4. Elizabeth made two bags out of ribbon. For one bag she used $\frac{7}{10}$ of a yard and for the other she used $\frac{5}{6}$ of a yard. How many yards in both?
5. Mary made three gingham caps. One cap required $\frac{5}{8}$ of a yard, another $\frac{3}{4}$ of a yard and the third $\frac{2}{3}$ of a yard. How many yards of gingham were required for the three caps?
6. Alice dressed a doll. She used $\frac{3}{4}$ of a yard of silk for the dress and $1\frac{2}{3}$ yards for a coat and bonnet. How many yards of material did she use for all?
7. She used $2\frac{1}{3}$ yards of lace on the dress and $1\frac{5}{8}$ yards of lace on the petticoat. How many yards of lace did she use for both?
8. The candy was in three boxes. The first box held $5\frac{5}{8}$ pounds, the second box $3\frac{3}{4}$ pounds and the third box $4\frac{1}{2}$ pounds. How many pounds did they have for sale?
9. The mothers sent doughnuts to be sold at the bazaar. Mrs. Smith sent $2\frac{2}{3}$ dozen, Mrs. Brown $4\frac{1}{4}$ dozen, and Mrs. Jones $3\frac{5}{6}$ dozen. How many dozen did they send?
10. Mr. Brown, Alice's father, said he would give five dollars to the bazaar if they could add correctly $8\frac{5}{6}$, $9\frac{1}{2}$, $10\frac{2}{3}$ and $22\frac{3}{4}$. Alice said the answer was $51\frac{3}{4}$. Did that give them the five dollars?

Find the sums of these mixed numbers:

1.	2.	3.	4.	5.
$4\frac{1}{2}$	$10\frac{1}{3}$	$12\frac{1}{5}$	$17\frac{5}{6}$	$7\frac{2}{9}$
$6\frac{3}{8}$	$8\frac{3}{4}$	$6\frac{2}{3}$	$14\frac{1}{3}$	$6\frac{2}{3}$
<u>$7\frac{1}{4}$</u>	<u>$16\frac{2}{3}$</u>	<u>$14\frac{3}{5}$</u>	<u>$22\frac{3}{4}$</u>	<u>$15\frac{1}{9}$</u>

6.	7.	8.	9.	10.
$23\frac{1}{2}$	$8\frac{3}{20}$	$15\frac{2}{3}$	$15\frac{4}{5}$	$11\frac{3}{8}$
$6\frac{5}{12}$	$16\frac{4}{5}$	$13\frac{7}{9}$	$7\frac{3}{10}$	$4\frac{5}{16}$
<u>$11\frac{1}{6}$</u>	<u>$12\frac{1}{2}$</u>	<u>$5\frac{1}{6}$</u>	<u>$15\frac{7}{20}$</u>	<u>$17\frac{3}{4}$</u>

Speed and Accuracy Practice

Perform the following additions, timing yourself and keeping a record of mistakes made. After a few days do the list again, seeing how much you can improve your record for speed and accuracy:

- | | |
|---------------------------------|---|
| 1. $\frac{7}{8} + \frac{2}{3}$ | 7. $\frac{9}{20} + \frac{3}{5}$ |
| 2. $\frac{5}{6} + \frac{3}{4}$ | 8. $\frac{11}{15} + \frac{1}{2}$ |
| 3. $\frac{7}{16} + \frac{5}{8}$ | 9. $\frac{3}{16} + \frac{3}{4}$ |
| 4. $\frac{5}{8} + \frac{2}{5}$ | 10. $\frac{7}{10} + \frac{2}{3}$ |
| 5. $\frac{2}{9} + \frac{1}{2}$ | 11. $\frac{1}{2} + \frac{2}{3} + \frac{3}{4}$ |
| 6. $\frac{7}{12} + \frac{1}{5}$ | 12. $\frac{3}{5} + \frac{1}{4} + \frac{1}{3}$ |

Test yourself on these problems and questions: If there is any point on which you are not sure, turn back and look it up in your book.

1. Write five dissimilar fractions.
2. Write five similar fractions.
3. Write five mixed numbers.
4. What kind of fractions can be added?
5. What kind of fractions cannot be added?

6. If you *multiply* both numerator and denominator of a fraction by the same number, what effect does this have on its value? Show that your answer is true by writing a fraction and then multiplying its numerator and denominator by the same number.
7. If you *divide* both numerator and denominator of a fraction by the same number what effect does this have on its value? Write a fraction, then divide both numerator and denominator by the same number and show that the new fraction has the same value as the one with which you started.
8. What points about fractions so far have made you most trouble? Have you these points all cleared up so they will not make it hard for you as you go on? If not, look up troublesome points in the book. Your teacher will help you where you do not understand.

3. Subtraction of Fractions.

1. Henry picked $\frac{3}{4}$ of a bushel of hickory nuts. He sold $\frac{1}{4}$ of a bushel to Joe. What part of a bushel had he left?

$$\frac{3}{4} \text{ bu.} - \frac{1}{4} \text{ bu.} = \frac{2}{4} \text{ bu.}$$

2. A grocer had $\frac{2}{3}$ of a barrel of apples. From this he sold $\frac{1}{2}$ of a barrel. What part of a barrel had he left?

$$\frac{2}{3} \text{ bbl.} - \frac{1}{2} \text{ bbl.} = ?$$

You have learned that you cannot add *dissimilar* fractions. Neither can you subtract dissimilar fractions. Before you can subtract one fraction from another their denominators must be the same. Therefore think of $\frac{2}{3}$ bbl. as $\frac{4}{6}$ bbl.

Think of $\frac{1}{2}$ bbl. as $\frac{3}{6}$ bbl.

$$\frac{4}{6} \text{ bbl.} - \frac{3}{6} \text{ bbl.} = \frac{1}{6} \text{ bbl.}$$

3. Jennie had a garden plot that was $8\frac{3}{4}$ feet wide. She took off on one side $1\frac{1}{3}$ feet for a path. How wide was the piece that was left? .

$$\begin{array}{r} 8\frac{3}{4} = 8\frac{9}{12} \\ 1\frac{1}{3} = 1\frac{4}{12} \\ \hline 7\frac{5}{12} \end{array}$$

The numbers may be rewritten using 12 as the least common denominator. After a little practice you can *think* how many twelfths in each fraction and subtract without rewriting the numbers.

Therefore the piece that was left was $7\frac{5}{12}$ feet wide.

4. From a can that held 5 gallons of oil, $1\frac{1}{5}$ gallons leaked out. How many gallons remained?

$$\begin{array}{r} 5 \\ 1\frac{1}{5} \\ \hline 3\frac{4}{5} \end{array}$$

Take 1 from the 5.

Think: $1 = \frac{5}{5}$.

Then the problem becomes $4\frac{5}{5} - 1\frac{1}{5}$. The remainder is $3\frac{4}{5}$.

5. Mary and Josie started to walk to a camp which was $3\frac{1}{8}$ miles from their home. When they had walked $2\frac{1}{4}$ miles they stopped to rest. How much farther had they to go?

$$\begin{array}{r} 3\frac{1}{8} \\ 2\frac{1}{4} \\ \hline 7\frac{7}{8} \end{array}$$

$\frac{1}{8}$ is smaller than $\frac{1}{4}$, so take 1 from 3.

Think: $1 = \frac{8}{8}$ and add this to the $\frac{1}{8}$.

Then the problem becomes $2\frac{9}{8} - 2\frac{1}{4}$. Reduce the fractions to those having common denominators, and subtract. The remainder is $\frac{7}{8}$.

6. How much greater is $\frac{7}{8}$ of an inch than $\frac{1}{2}$ an inch?
7. Mr. Riggs found that his empty wagon weighed $\frac{3}{4}$ of a ton. He loaded it and the load and the wagon weighed $2\frac{1}{8}$ tons. What weight was the load alone?
8. Fred grew $3\frac{1}{2}$ inches in one year. Herbert grew only $1\frac{1}{8}$ inch. How much more did Fred grow than Herbert?

9. Mr. Anton had a tract of 40 acres. At different times he sold these parts: $\frac{1}{2}$ acre, $\frac{1}{3}$ acre, $\frac{1}{4}$ acre, $1\frac{1}{2}$ acres. How many acres did he have left?
10. James raised $\frac{3}{5}$ of a bushel of beans and Lloyd raised $\frac{1}{12}$ of a bushel. Which raised more, and how much?

Add or subtract each of these as the sign directs:

1. $\frac{1}{2} + \frac{2}{5} =$

7. $\frac{1}{8} + \frac{1}{5} =$

13. $\frac{1}{2} - \frac{1}{4} =$

2. $\frac{2}{3} + \frac{1}{4} =$

8. $\frac{4}{5} - \frac{1}{8} =$

14. $\frac{5}{8} + \frac{1}{4} =$

3. $\frac{3}{8} - \frac{1}{3} =$

9. $\frac{2}{5} + \frac{1}{3} =$

15. $\frac{4}{5} - \frac{3}{4} =$

4. $\frac{3}{4} - \frac{1}{3} =$

10. $\frac{1}{2} - \frac{1}{8} =$

16. $\frac{7}{8} + \frac{2}{3} =$

5. $\frac{7}{8} - \frac{1}{2} =$

11. $\frac{7}{9} - \frac{2}{3} =$

17. $\frac{5}{6} - \frac{1}{2} =$

6. $\frac{3}{5} - \frac{1}{2} =$

12. $\frac{3}{4} - \frac{3}{8} =$

18. $\frac{9}{16} - \frac{1}{4} =$

Every-Day Problems

1. Henry wanted to go from camp to a town 14 miles away. He walked $5\frac{2}{3}$ miles and rode the rest of the way. How far did he ride?
2. On his return Henry walked $6\frac{1}{2}$ miles and rode the rest of the way. How far did he ride returning?
3. Joe had $\frac{3}{4}$ of a dollar and he spent $\frac{3}{5}$ of a dollar. What part of a dollar was left? How many cents?
4. On a standing jump John made $6\frac{2}{3}$ feet and James $5\frac{1}{3}$ feet. How much farther did John jump than James?
5. The lake is $3\frac{7}{8}$ miles across. William rowed $2\frac{1}{3}$ miles and then decided to turn back. How much farther would William have had to row to cross the lake?

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6. Henry could row a mile in $12\frac{1}{2}$ minutes and John in $10\frac{3}{4}$ minutes. How many minutes faster was John than Henry?
7. It took William $55\frac{2}{5}$ seconds and James $57\frac{1}{2}$ seconds to swim 100 yards. What was the difference in time?
8. In the athletic contests Tom could make $5\frac{1}{2}$ feet in a running high jump and Jack could make $4\frac{1}{8}$ feet. How much higher could Tom jump than Jack?
9. Charles can make a running broad jump of $12\frac{4}{5}$ feet. Harry's record is $15\frac{1}{8}$ feet. How much better is Harry's record than Charles'?
10. There are two running tracks at camp. One is $\frac{3}{8}$ of a mile long and the other is $\frac{1}{4}$ of a mile long. What fraction of a mile is one track longer than the other?
11. Leonard and Josephine are twins. On the day they were eleven years old Leonard was $53\frac{5}{16}$ inches tall and Josephine $52\frac{3}{4}$ inches. How much taller was Leonard than his sister?
12. On the same day Leonard weighed $70\frac{1}{2}$ pounds and Josephine $68\frac{3}{4}$ pounds. How much heavier was Leonard than Josephine?
13. The average weight for boys of 12 years is $83\frac{2}{3}$ pounds. Harry at that age weighs $81\frac{1}{4}$ pounds. How much is he below average weight?
14. The average weight of girls at 12 years is $84\frac{7}{16}$ pounds. Julia at that age weighs $86\frac{3}{8}$ pounds. How much is she over average weight?
15. Robert says he is going to do his best to reach a weight of 84 pounds by his twelfth birthday. He now weighs $79\frac{3}{8}$ pounds. How much has he still to gain?

16. Ethel plans a camping trip that will cost $\$9\frac{3}{4}$. She now has $\$6\frac{2}{5}$. How much more will she need?
17. Charles lives on a farm and manages the poultry. He told his mother that he hoped to sell 45 dozen eggs each week. He actually sold an average of $51\frac{2}{3}$ dozen. By how much was his sale larger than his estimate?
18. Margaret's clothes cost $\$56\frac{4}{5}$ this year. Last year they cost $\$49\frac{1}{4}$. How much more do they cost this year than last?

In each example subtract the smaller fraction from the larger:

1. $\frac{9}{16}$ and $\frac{5}{8}$

6. $\frac{4}{5}$ and $\frac{3}{8}$

11. $\frac{1\frac{2}{11}}$ and 1

2. $\frac{5}{12}$ and $\frac{3}{8}$

7. $\frac{3}{4}$ and $\frac{2}{3}$

12. $1\frac{1}{2}$ and $\frac{4}{2}$

3. $\frac{1}{2}$ and $\frac{5}{8}$

8. $\frac{5}{6}$ and $\frac{2}{3}$

13. $\frac{3}{8}$ and $\frac{4}{7}$

4. $\frac{3}{8}$ and $\frac{1}{2}$

9. $\frac{8}{7}$ and $\frac{5}{6}$

14. $\frac{5}{9}$ and $\frac{7}{12}$

5. $\frac{5}{6}$ and $\frac{1}{2}$

10. $\frac{3}{4}$ and $\frac{5}{8}$

15. $\frac{7}{8}$ and $\frac{7}{10}$

Speed and Accuracy Practice

Perform the following subtractions with your best speed and accuracy, keeping a record of the time required and the number of mistakes. *Check your answers by adding.*

Do the same list again within a few days, seeing how much you can improve your record.

$$\begin{array}{r} 1. \quad 29\frac{3}{5} \\ \quad 17\frac{1}{3} \\ \hline \end{array}$$

$$\begin{array}{r} 3. \quad 51\frac{7}{8} \\ \quad 46\frac{3}{4} \\ \hline \end{array}$$

$$\begin{array}{r} 2. \quad 83\frac{2}{3} \\ \quad 79\frac{2}{5} \\ \hline \end{array}$$

$$\begin{array}{r} 4. \quad 20\frac{8}{9} \\ \quad 19\frac{2}{3} \\ \hline \end{array}$$

$$\begin{array}{r} 5. \quad 40\frac{5}{6} \\ \quad 15\frac{1}{3} \\ \hline \end{array}$$

$$\begin{array}{r} 9. \quad 91\frac{15}{16} \\ \quad 37\frac{3}{8} \\ \hline \end{array}$$

$$\begin{array}{r} 6. \quad 13\frac{3}{8} \\ \quad 9\frac{1}{5} \\ \hline \end{array}$$

$$\begin{array}{r} 10. \quad 55\frac{4}{5} \\ \quad 44\frac{3}{4} \\ \hline \end{array}$$

$$\begin{array}{r} 7. \quad 25\frac{3}{4} \\ \quad 16\frac{3}{5} \\ \hline \end{array}$$

$$\begin{array}{r} 11. \quad 10\frac{7}{10} \\ \quad 9\frac{1}{3} \\ \hline \end{array}$$

$$\begin{array}{r} 8. \quad 61\frac{5}{12} \\ \quad 36\frac{1}{4} \\ \hline \end{array}$$

$$\begin{array}{r} 12. \quad 83\frac{3}{7} \\ \quad 21\frac{1}{2} \\ \hline \end{array}$$

4. Counting by Fractional Parts.

1. During the school year there were 6 half-day holidays. How many days of school work were lost?
2. The eighth grade had perfect attendance for 4 months during the year. For each month of perfect attendance they were given a half-day holiday. How many full holidays did they get?
3. At Winona, Minnesota, the Mississippi River rose $\frac{1}{3}$ of a foot each day for 6 days when the snow was melting. How many feet did it rise in the 6 days?
4. At Winona the Mississippi River went down $\frac{1}{4}$ of a foot each day for 4 days. How many feet did it go down?

5. George's father has a truck farm divided into $\frac{1}{5}$ -acre plots. There are 10 of these plots planted. How many acres are planted?
6. A grocer sold $\frac{1}{2}$ of a peck of spinach to each of 12 different customers. How many pecks did he sell?
7. Dick's pony eats $\frac{1}{2}$ peck of corn each day. How many pecks does the pony eat in 8 days?
8. A truck gardener sold $\frac{1}{2}$ of a bushel of potatoes to each of 6 housewives. How many bushels did he sell?
9. Count by thirds until you reach 2. Count the same by fourths, by fifths, by eighths, by tenths.
10. Mr. Jones picked a bushel basket of tomatoes from his vines. He wished to divide them between two neighbors so that each would receive the same amount. What part of a bushel should he give each?
11. Mrs. East finds that she needs to buy one pound of butter every two days for table use. How much does she use each day?
12. A boarding house uses one bushel of potatoes every three days. What part of a bushel is used each day?

Give the answers to the following as fast as you can, without copying the problems:

- | | | | |
|-------------------|--------------------|--------------------|--------------------|
| 1. $2 \times 8 =$ | 6. $8 \times 7 =$ | 11. $4 \times 4 =$ | 16. $9 \times 5 =$ |
| 2. $8 \times 4 =$ | 7. $7 \times 3 =$ | 12. $8 \times 8 =$ | 17. $2 \times 9 =$ |
| 3. $6 \times 4 =$ | 8. $6 \times 9 =$ | 13. $7 \times 3 =$ | 18. $6 \times 8 =$ |
| 4. $5 \times 7 =$ | 9. $8 \times 4 =$ | 14. $5 \times 9 =$ | 19. $7 \times 4 =$ |
| 5. $9 \times 2 =$ | 10. $6 \times 9 =$ | 15. $7 \times 8 =$ | 20. $9 \times 7 =$ |

Practice these till you can answer rapidly without error:

- | | | |
|-----|---------------------|-----------------------|
| 21. | How many 2's in 4? | What part of 4 is 2? |
| 22. | How many 3's in 6? | What part of 6 is 3? |
| 23. | How many 5's in 15? | What part of 15 is 5? |
| 24. | How many 4's in 12? | What part of 12 is 4? |
| 25. | How many 6's in 18? | What part of 18 is 6? |
| 26. | How many 7's in 28? | What part of 28 is 7? |
| 27. | How many 3's in 12? | What part of 12 is 3? |
| 28. | How many 2's in 10? | What part of 10 is 2? |
| 29. | How many 5's in 10? | What part of 10 is 5? |
| 30. | How many 8's in 24? | What part of 24 is 8? |
| 31. | How many 9's in 36? | What part of 36 is 9? |
| 32. | How many 7's in 21? | What part of 21 is 7? |
| 33. | How many 5's in 50? | What part of 50 is 5? |
| 34. | How many 6's in 30? | What part of 30 is 6? |
| 35. | How many 4's in 32? | What part of 32 is 4? |
| 36. | How many 2's in 20? | What part of 20 is 2? |

1. What part of 16 is 4?
2. What part of 18 is 6?
3. What part of 27 is 9?
4. What part of 36 is 6?
5. What part of 55 is 5?
6. What part of 45 is 9?
7. What part of 72 is 8?
8. What part of 81 is 9?
9. What part of 56 is 7?
10. What part of 84 is 12?

11. What part of 108 is 9?
12. What part of 96 is 8?
13. What part of 64 is 8?
14. What part of 30 is 5?
15. What part of 96 is 12?

5. Review and Application.

1. The walls of a schoolroom are $15\frac{3}{4}$ feet high. Four and two-thirds feet of this is blackboard space. How wide is the part that is left to be painted?
2. The picture molding is placed $2\frac{1}{2}$ feet from the top of the wall in example 1. How high is the molding from the floor?
3. The top of a flag pole is 8 feet from the ground. The flag itself is $3\frac{1}{4}$ feet wide. How far is the lower edge of the flag from the ground?
4. It takes $1\frac{1}{4}$ pints of ink to fill the ink wells. If the janitor has a can holding 4 quarts how many pints are left after filling the wells?
5. A new book shelf was needed. From a board $5\frac{2}{3}$ feet long the boys cut a shelf $3\frac{1}{2}$ feet long. How long was the piece that was left?
6. Robert made two window boxes. One was $40\frac{1}{2}$ inches long and the other $25\frac{1}{4}$ inches long. How much longer was one than the other?
7. The desk blotter was $28\frac{1}{2}$ inches long and the teacher cut off $5\frac{1}{3}$ inches. How long is the piece which is left?
8. Margaret made an apron and cap. She used $1\frac{1}{2}$ yards for the apron and $\frac{3}{4}$ of a yard for the cap. How much material did she use?

9. Margaret trimmed them with lace and ribbon. It required $2\frac{1}{4}$ yards of lace for the apron and $\frac{7}{8}$ of a yard of lace for the cap. How much lace did she use?
10. Margaret made bows of ribbon using $2\frac{1}{2}$ yards for the apron and $1\frac{4}{5}$ yards for the cap. How much ribbon did she use?
11. After finishing the apron and cap, Margaret decided to make two laundry bags for Christmas. She bought $1\frac{2}{3}$ yards of linen for one bag and $2\frac{1}{5}$ yards for the other. How much linen did she buy?
12. Elizabeth's mother said she might have new things for her room. She bought $10\frac{2}{5}$ yards of cretonne for the curtains and $2\frac{3}{4}$ yards to be used for cushions. How much cretonne did she buy?
13. Fred has a garden plot $25\frac{2}{3}$ feet wide and $32\frac{1}{2}$ feet long. How much greater is the length than the width?
14. He has a strawberry bed $6\frac{1}{4}$ feet wide running lengthwise along one side of the garden. How wide is the remaining portion of the garden?
15. Along the strawberry bed lay a path $1\frac{1}{3}$ feet wide. How much wider was the strawberry bed than the path?
16. He had $\$25\frac{1}{4}$ in the bank. He withdrew $\$2\frac{1}{2}$ for garden seed and potatoes. What was left in the bank?
17. He spent $\$1\frac{3}{4}$ for seed and twice as much for tools. What did he spend for tools?
18. He planted $\frac{3}{8}$ of a bushel of seed potatoes and raised $12\frac{1}{4}$ bushels of potatoes. How much greater was the yield than the amount planted?

19. He displayed two of his potatoes at the county fair. One weighed $2\frac{3}{8}$ pounds and the other $1\frac{3}{4}$ pounds. What was the difference in their weight? What was their combined weight?
20. He also displayed two cabbages. One weighed $8\frac{1}{8}$ pounds, and the second weighed $7\frac{3}{4}$ pounds. Find the difference in their weights. Find their combined weight.
21. He raised $3\frac{3}{4}$ bushels of tomatoes. How many more bushels of potatoes than of tomatoes did he raise?
22. He received $\$65\frac{1}{4}$ for his vegetables, and his total expenses were $\$10\frac{1}{2}$. How much did he make from his garden?
23. Sarah had music lessons and was to practice $6\frac{1}{2}$ hours a week. This record shows her practice during one week:

Monday	$\frac{1}{2}$	hour
Tuesday	$1\frac{1}{4}$	hour
Wednesday	$\frac{5}{8}$	hour
Thursday	$\frac{7}{12}$	hour
Friday	$1\frac{1}{3}$	hour

Sarah's mother asked her how many hours she had left for Saturday? Sarah answered, "One and three-fourths hours." Was she right?

24. The fifth-grade class was working on a test in arithmetic that was supposed to be finished in just $5\frac{1}{2}$ minutes. Here is the record the different pupils made:

William finished in $5\frac{3}{4}$ min.

Rufus finished in $4\frac{2}{3}$ min.

Virginia finished in $5\frac{2}{3}$ min.

Violet finished in $3\frac{7}{8}$ min.

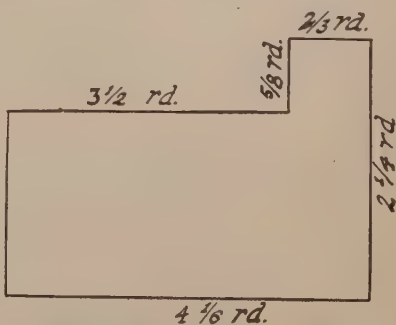
Thomas finished in $6\frac{1}{3}$ min.

Dorothy finished in $4\frac{5}{8}$ min.

Joseph finished in $5\frac{3}{12}$ min.

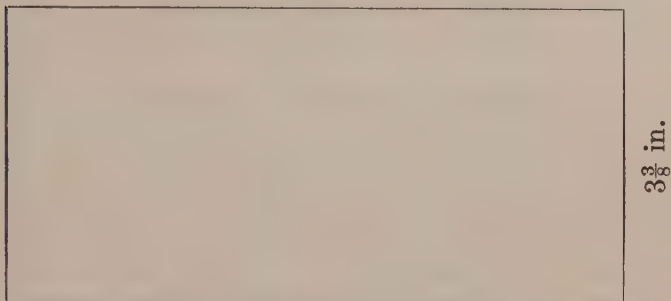
Find out how much each one was faster or slower than the standard. Remember that the standard was $5\frac{1}{2}$ minutes.

25. Mother baked 2 pies for dinner on a day when there were 10 to be served. What part of a pie did each person get?
26. Joe said he would like $\frac{1}{4}$ of a pie. How much less than that did he get?
27. Mary said that $\frac{1}{6}$ of a pie would do for her. How much more than that did she get?
28. Tom has a garden plot that measures as shown in this diagram. How many rods of fence will be required to enclose the garden?
29. On the long side there is already a fence that extends $2\frac{1}{3}$ rods from the right-hand corner. How many rods of fencing does this leave for Tom to buy to fence his garden?



30. Mary is making a telephone pad for her mother's Christmas present. The back of the pad is like this:

$6\frac{3}{4}$ in.



She wants to cut a piece of red paper the right size to paste on this card and turn $\frac{3}{4}$ of an inch over to paste on the other side. What size must she cut the red paper?

31. Laura wants to mount on cardboard a picture that measures $9\frac{1}{2}$ inches at top and bottom by $6\frac{5}{8}$ inches at each end. She plans to allow a margin of $1\frac{3}{4}$ inches on each side and $2\frac{1}{2}$ inches at the top and bottom. What must be the size of the cardboard?

Do the following examples accurately and as quickly as you can. Before starting to work each example be sure that you know what is to be done with the numbers in it.

1. $\frac{2}{3} + \frac{1}{5}$

7. $1\frac{4}{5} - \frac{2}{3}$

13. $\frac{6}{5} - \frac{3}{10}$

2. $\frac{3}{5} - \frac{1}{8}$

8. $2\frac{1}{6} - 1\frac{1}{8}$

14. $2\frac{2}{3} - 1\frac{5}{6}$

3. $\frac{3}{4} + \frac{2}{3}$

9. $2\frac{4}{9} + 1\frac{2}{3}$

15. $1\frac{7}{8} + \frac{3}{4}$

4. $\frac{5}{8} - \frac{2}{5}$

10. $3\frac{1}{2} - 3\frac{1}{3}$

16. $\frac{9}{5} - 1\frac{4}{5}$

5. $\frac{3}{4} - \frac{1}{8}$

11. $4\frac{1}{4} + 4\frac{1}{5}$

17. $\frac{3}{2} - \frac{2}{3}$

6. $\frac{1}{3} - \frac{1}{5}$

12. $2\frac{7}{8} - 1\frac{1}{6}$

18. $\frac{3}{2} + \frac{2}{3}$

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19. $\frac{5}{6} - \frac{3}{5}$

20. $\frac{3}{8} + \frac{1}{5}$

21. $\frac{1}{6} + \frac{2}{3}$

22. $\frac{5}{16} + \frac{5}{8}$

23. $10\frac{1}{5} - 9\frac{1}{6}$

24. $\frac{8}{7} - 1\frac{1}{8}$

25. $3\frac{4}{5} + 3\frac{2}{3}$

26. $1\frac{7}{8} - \frac{3}{16}$

27. $\frac{3}{8} + \frac{8}{3}$

28. $\frac{8}{3} - \frac{3}{8}$

29. $\frac{27}{8} - \frac{2}{3}$

30. $\frac{15}{16} - \frac{4}{5}$

III. FRACTIONS: MULTIPLICATION AND DIVISION

1. Finding a Fractional Part of a Number.

Find $\frac{3}{4}$ of 8 inches.

Measure with your ruler, and then cut a strip of paper just 8 inches long.

Fold the paper with the crease the short way. Fold it once more the same way. Into how many parts do the creases divide the 8-inch strip?

Measure one of these parts. How many inches long is $\frac{1}{4}$ of the strip? How many inches long is $\frac{3}{4}$ of the strip?

How do you find $\frac{1}{4}$ of 8 inches?

After you know $\frac{1}{4}$ of 8 inches how do you find $\frac{3}{4}$ of 8 inches?

$\frac{1}{4}$ of 8 inches = 2 inches.

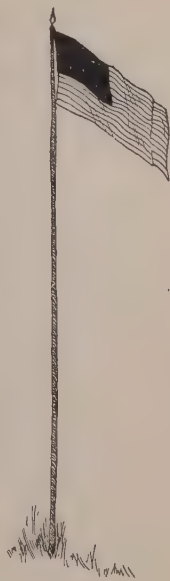
$\frac{3}{4}$ of 8 inches = 3×2 inches, or 6 inches.

To find a fractional part of a number divide the number by the denominator of the fraction and multiply the result by the numerator.

Problems

1. The fifth-grade arithmetic class has 30 pupils, of whom $\frac{2}{5}$ are girls and $\frac{3}{5}$ are boys. How many girls are in the class? How many boys?

2. Jane is canning berries. The recipe calls for 2 pounds of sugar for 4 quarts of berries. Jane has 3 quarts of berries in the kettle. How many pounds of sugar are required? What is $\frac{3}{4}$ of 2 pounds?
3. The Whittier School had a flag pole 100 feet high. A storm broke off the top $\frac{1}{4}$. How many feet of the pole were left standing?
4. Oranges were quoted at 48¢ a dozen. At this rate what would 8 oranges cost?
5. A painter was to receive \$8 for a day's work. He put in only $\frac{3}{4}$ of a day. How much should he receive?
6. At 27¢ a yard what will 16 inches of ribbon cost?
7. Julia bought lamb chops that were quoted at 32¢ a pound. The scales showed 12 ounces. How many cents should Julia pay?
8. Virginia has read $\frac{3}{4}$ of the way through a book that has 260 pages. How many pages has she read?
9. Fred asked his father how many days of school remained before the summer vacation. His father said, "Two-ninths of the school year remain." The school year had 36 weeks of 5 days each. How many days remained?
10. Dan's father told him he would pay $\frac{5}{8}$ toward a new bicycle for Dan if Dan would earn the other $\frac{3}{8}$. The bicycle was to cost \$32. How much would Dan have to earn? How much would his father pay?



11. Find the fractional parts indicated. See how many you can do without pencil. Work fast but get the answers right:

a. $\frac{1}{3}$ of 24	j. $\frac{9}{16}$ of 128	s. $\frac{3}{4}$ of 392
b. $\frac{2}{3}$ of 24	k. $\frac{4}{5}$ of 90	t. $\frac{7}{8}$ of 344
c. $\frac{5}{6}$ of 30	l. $\frac{2}{30}$ of 1350	u. $\frac{5}{9}$ of 189
d. $\frac{3}{8}$ of 48	m. $\frac{2}{3}$ of 960	v. $\frac{9}{11}$ of 110
e. $\frac{7}{12}$ of 60	n. $\frac{7}{8}$ of 6048	w. $\frac{6}{25}$ of 500
f. $\frac{3}{10}$ of 40	o. $\frac{7}{9}$ of 3636	x. $\frac{19}{20}$ of 100
g. $\frac{5}{7}$ of 35	p. $\frac{16}{25}$ of 200	y. $\frac{17}{1}$ of 294
h. $\frac{7}{12}$ of 48	q. $\frac{3}{4}$ of 500	z. $\frac{23}{24}$ of 120
i. $\frac{6}{7}$ of 28	r. $\frac{11}{12}$ of 144	

12. Tom and James mowed Mr. Johnson's lawn and received \$2.40 for their work. Tom was older than James and so did more of the work. They agreed to divide the pay so that Tom would receive $\frac{5}{8}$ of it and James $\frac{3}{8}$. What was the share of each?
13. The Bronson family went on an automobile trip of 360 miles. When they reached the town of Springville Mr. Bronson said they had come just $\frac{5}{12}$ of the way. How far was Springville from the Bronson home? How far was it from the end of their journey?
14. The Emerson School started out to raise \$125 for playground apparatus. When they had all the money the teacher said the fifth grade had raised $\frac{2}{5}$ of the amount. How many dollars did the fifth grade raise? How many dollars did the rest of the school raise?

15. Jamie and Edna asked their father to weigh them. He weighed Jamie first and said he weighed just 63 pounds. Then he weighed Edna and said, "Edna weighs $\frac{7}{9}$ as much as Jamie." How many pounds did Edna weigh?
16. Isabel and Homer's father said that because Homer was $\frac{2}{3}$ as old as Isabel he might have $\frac{2}{3}$ as much money each week as Isabel received for an allowance. Isabel received 60 cents a week. How much did Homer receive?

Do these rapidly but be sure you are right:

- | | | |
|--------------------------|--------------------------|--------------------------|
| 1. $\frac{2}{3}$ of 138 | 11. $\frac{1}{9}$ of 576 | 21. $\frac{5}{9}$ of 855 |
| 2. $\frac{1}{2}$ of 130 | 12. $\frac{3}{8}$ of 664 | 22. $\frac{5}{6}$ of 510 |
| 3. $\frac{4}{9}$ of 648 | 13. $\frac{2}{3}$ of 162 | 23. $\frac{3}{4}$ of 344 |
| 4. $\frac{5}{6}$ of 252 | 14. $\frac{1}{2}$ of 174 | 24. $\frac{3}{8}$ of 752 |
| 5. $\frac{3}{4}$ of 172 | 15. $\frac{3}{7}$ of 511 | 25. $\frac{1}{8}$ of 600 |
| 6. $\frac{2}{5}$ of 160 | 16. $\frac{5}{8}$ of 312 | 26. $\frac{2}{9}$ of 837 |
| 7. $\frac{3}{4}$ of 300 | 17. $\frac{2}{3}$ of 294 | 27. $\frac{3}{7}$ of 588 |
| 8. $\frac{3}{5}$ of 320 | 18. $\frac{3}{5}$ of 430 | 28. $\frac{4}{9}$ of 585 |
| 9. $\frac{2}{7}$ of 672 | 19. $\frac{3}{7}$ of 315 | 29. $\frac{5}{6}$ of 378 |
| 10. $\frac{5}{9}$ of 837 | 20. $\frac{5}{8}$ of 368 | 30. $\frac{5}{6}$ of 576 |

2. Multiplying a Fraction or a Mixed Number by an Integer.

1. The Longfellow School chose blue for the school color. In making some school banners they needed 7 pieces of ribbon each $\frac{1}{8}$ of a yard long. How much ribbon should they buy?

$$7 \times \frac{1}{8} \text{ yd.} = \frac{7}{8} \text{ yd.}$$

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To multiply a fraction by a whole number, multiply the numerator by that number and place the result over the denominator.

2. James and Henry took the job of carrying a wagon load of potatoes down into Mr. Jones' cellar. The potatoes were in bags that held one bushel each. A full bag was too heavy to carry, so the boys used a pail that held just $\frac{1}{3}$ of a bushel. In moving all the potatoes they had to carry 66 pailfuls. How many bushels of potatoes did they put in the cellar?

$$66 \times \frac{1}{3} = \frac{66}{3}$$

$$\frac{66}{3} = 22$$

Therefore the boys put 22 bushels in the cellar.

3. George dug $\frac{3}{4}$ of a bushel of potatoes each day for 6 days. How many bushels had he dug?
4. A train goes $\frac{2}{3}$ of a mile in 1 minute. How far will it go in 30 minutes?
5. James has a dog that drinks $\frac{1}{3}$ of a gallon of milk a day. How many gallons of milk does it drink each week?
6. Mary walks $\frac{3}{4}$ of a mile 4 times a day. How many miles does she walk during the day?
7. If it requires $\frac{1}{12}$ of a yard of material for 1 apron, how many yards will be needed for 6 aprons?
8. It requires $\frac{7}{8}$ of a yard of crash for a kitchen towel. How many yards must be bought for 9 towels?
9. Esther filled 12 boxes of candy. In each she put $\frac{5}{8}$ of a pound. How many pounds of candy did she use?

Perform the following multiplications. Do not use pencil.

1. $3 \times \frac{1}{4}$

6. $8 \times \frac{3}{4}$

11. $10 \times \frac{1}{8}$

2. $4 \times \frac{1}{5}$

7. $6 \times \frac{2}{7}$

12. $3 \times \frac{7}{10}$

3. $2 \times \frac{1}{8}$

8. $9 \times \frac{3}{5}$

13. $8 \times \frac{9}{16}$

4. $7 \times \frac{1}{6}$

9. $5 \times \frac{4}{9}$

14. $6 \times \frac{9}{12}$

5. $4 \times \frac{2}{3}$

10. $7 \times \frac{8}{9}$

15. $2 \times \frac{9}{20}$

Speed and Accuracy Practice

Perform these multiplications at your best speed, being careful not to make mistakes. Time yourself, and a few days later work the same list and compare records of time and accuracy to see how much you have improved. Express all answers in lowest terms.

1. $24 \times \frac{3}{8}$

5. $36 \times \frac{4}{9}$

9. $105 \times \frac{7}{15}$

2. $60 \times \frac{5}{6}$

6. $120 \times \frac{5}{12}$

10. $84 \times \frac{11}{14}$

3. $35 \times \frac{3}{5}$

7. $39 \times \frac{5}{13}$

11. $96 \times \frac{5}{16}$

4. $20 \times \frac{3}{4}$

8. $66 \times \frac{2}{11}$

12. $40 \times \frac{9}{10}$

Problems

1. Mr. Harwood picked 64 baskets of apples. Each basket held $\frac{3}{4}$ of a bushel. He sold the apples for \$1.50 a bushel. How much did he receive?
2. In serving 24 guests at a party Josephine's mother served each person $\frac{1}{2}$ of a grapefruit. How many grapefruit did she require?
3. Mr. Smith finds that his furnace requires an average of $\frac{3}{8}$ of a ton of coal a week through the winter. How many tons will be required for 20 weeks?

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4. On the Overman farm the cows lower the silage in the silo $\frac{1}{4}$ of a foot a day. If one filling of the silo is to last the cows 140 days, how high must the silo be?
5. For a play given by the fifth grade each of the 24 girls needed $\frac{3}{8}$ of a yard of cambric for a cap. What was the cost at 15 cents a yard?
6. Each of the 24 boys used a sash that required $\frac{5}{8}$ of a yard of cambric. How many yards were needed?
7. A jar holds $\frac{7}{8}$ of a quart. David fills it 15 times in emptying some milk from a can. How many quarts of milk were in the can?
8. Harold and Glen walked $2\frac{1}{2}$ miles an hour for 3 hours. How far did they walk?

$$2\frac{1}{2} = \frac{5}{2}$$

$$3 \times \frac{5}{2} = \frac{15}{2}$$

$$\frac{15}{2} = 7\frac{1}{2}$$

Therefore they walked $7\frac{1}{2}$ miles.

To multiply a mixed number by a whole number, change the mixed number to an improper fraction and proceed as in multiplying any fraction.

9. If it takes $2\frac{3}{4}$ bushels of seed to the acre, how many bushels will be needed to seed 45 acres?
10. Each complete turn of the handle of a screw driver makes a screw go into the wood $\frac{3}{16}$ of an inch. How far into the wood will the screw have gone after 8 complete turns?

11. The following is a recipe for pie crust:

Flour, $1\frac{3}{4}$ cups

Lard, $\frac{3}{8}$ of a cup

Baking powder, $\frac{1}{2}$ of a teaspoonful

Salt, $\frac{3}{4}$ of a teaspoonful

Water, $\frac{1}{4}$ of a cup.

Change this recipe so as to make it read for three times the original amount.

12. You can buy flour in $24\frac{1}{2}$ pound sacks. How many pounds in 37 such sacks?

3. Multiplying an Integer by a Fraction.

1. What is $\frac{1}{2}$ of 24 hours? $\frac{1}{3}$ of \$6? $\frac{1}{4}$ of 8 days?

2. What is $\frac{1}{5}$ of 15 cents? $\frac{1}{8}$ of 24 months?

Think what you do to each of these whole numbers in getting your answers.

3. What is $\frac{2}{3}$ of 12 miles? $\frac{2}{5}$ of 10 days?

4. What is $\frac{3}{4}$ of \$20? $\frac{3}{8}$ of 48 feet?

Think what you do to get the right fractional part of each whole number. What do you do first? What do you do next?

5. What is $\frac{1}{5}$ of 90 days? How did you get the answer?

6. What is $\frac{2}{6}$ of 90 days? How did you get the answer?

7. What is $\frac{4}{5}$ of 90 days?

8. What is $\frac{3}{5}$ of 90 days?

9. What is $\frac{2}{3}$ of 20 minutes?

In this example you cannot divide 20 by 3 without a remainder, so you first multiply the 20 by the 2, and then divide by the 3.

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10. What is $\frac{3}{4}$ of 15 acres? $\frac{3}{8}$ of 25 gallons? What is $\frac{4}{5}$ of 16 apples?

To multiply a whole number by a fraction, first multiply the number by the numerator of the fraction, and then divide by the denominator. •

Perform the following multiplications:

1. $\frac{2}{3} \times 14$

6. $\frac{2}{7} \times 52$

11. $\frac{7}{12} \times 42$

2. $\frac{4}{5} \times 23$

7. $\frac{4}{9} \times 13$

12. $\frac{4}{7} \times 96$

3. $\frac{1}{2} \times 75$

8. $\frac{5}{6} \times 34$

13. $\frac{3}{8} \times 54$

4. $\frac{1}{6} \times 32$

9. $\frac{3}{5} \times 28$

14. $\frac{5}{9} \times 30$

5. $\frac{5}{12} \times 63$

10. $\frac{7}{8} \times 48$

15. $\frac{3}{4} \times 70$

Problems

- Mabel was given \$2.50 to buy materials. She spent $\frac{1}{5}$ of it for ribbon, $\frac{2}{5}$ of it for linen and $\frac{2}{5}$ of it for lace. How much did she spend for each?
- She had 5 yards of ribbon. For one book mark she used $\frac{1}{10}$ of it. How long was the part she used?
- Mary plans to spend $\$ \frac{3}{4}$ on each member of her family for Christmas. If there are 8 people for whom she buys presents, how much must she spend?
- Jean wished to plant a tulip bed. Her father sent to Holland and bought 120 bulbs. If the bulbs weighed $\frac{1}{8}$ of a pound each how much did the tulips weigh?
- When the 120 bulbs came, she gave $\frac{1}{6}$ of them to her friend. How many did she give to her friend?

6. She planted 105 tulip bulbs in October just before the ground froze. In the spring she discovered that $\frac{4}{5}$ of all she planted were growing. How many grew?
7. A little later she counted 288 blossoms. Out of these $\frac{2}{3}$ were red ones. How many red tulips were there?
8. From the 105 bulbs only $\frac{2}{7}$ failed to bloom that spring. How many bulbs did not bloom?
9. Of the 288 blossoms, she sent $\frac{1}{6}$ to the hospital to be distributed to the sick. How many tulips did she send to the hospital?
10. What is $\frac{3}{4}$ of 15 acres?
11. What is $\frac{3}{8}$ of 25 gallons?
12. What is $\frac{4}{5}$ of 16 apples?

Speed and Accuracy Practice

Time yourself and keep a record of your accuracy on these multiplications. Do the list again later and try for improvement:

- | | | |
|-------------------------------|------------------------------|-------------------------------|
| 1. $\frac{2}{2} \times 72$ | 11. $\frac{6}{7} \times 147$ | 21. $\frac{7}{24} \times 48$ |
| 2. $\frac{5}{9} \times 81$ | 12. $\frac{5}{6} \times 186$ | 22. $\frac{3}{20} \times 30$ |
| 3. $\frac{3}{7} \times 84$ | 13. $\frac{5}{6} \times 12$ | 23. $\frac{7}{15} \times 35$ |
| 4. $\frac{4}{5} \times 50$ | 14. $\frac{7}{8} \times 9$ | 24. $\frac{9}{16} \times 24$ |
| 5. $\frac{7}{8} \times 64$ | 15. $\frac{8}{9} \times 9$ | 25. $\frac{11}{24} \times 32$ |
| 6. $\frac{11}{12} \times 96$ | 16. $\frac{3}{4} \times 16$ | 26. $\frac{7}{6} \times 42$ |
| 7. $\frac{7}{15} \times 75$ | 17. $\frac{4}{5} \times 60$ | 27. $\frac{15}{8} \times 6$ |
| 8. $\frac{3}{4} \times 124$ | 18. $\frac{7}{12} \times 16$ | 28. $\frac{17}{6} \times 12$ |
| 9. $\frac{3}{10} \times 50$ | 19. $\frac{3}{8} \times 56$ | 29. $\frac{7}{9} \times 72$ |
| 10. $\frac{8}{16} \times 128$ | 20. $\frac{5}{16} \times 32$ | 30. $\frac{9}{8} \times 64$ |

Problems

1. John was to receive \$3 a day for his work. He worked $\frac{3}{4}$ of a day. How much should he receive?
2. Find the cost of $\frac{3}{4}$ of a pound of bananas at 30 cents a pound.
3. Mary bought $\frac{2}{3}$ of a pound of candy at 75 cents a pound, and $\frac{1}{4}$ of a pound at 80 cents a pound. How much did the candy cost?
4. At a school candy sale 4 pounds of candy were to fill 16 boxes of equal size. What part of a pound did each box contain? How many ounces of candy were there in each box?
5. Mrs. Keeler bought the following articles at the store.

Find the amount of her bill:

$\frac{1}{2}$ pound of tea at 60 cents a pound
 $\frac{3}{4}$ pound of bacon at 48 cents a pound
 $\frac{1}{2}$ peck of potatoes at 52 cents a peck
 $\frac{1}{2}$ dozen oranges at 64 cents a dozen
 2 ounces of paprica at \$1.20 a pound
 $\frac{1}{2}$ pound of cocoa at 50 cents a pound

3. Four boys went on a camping trip. Each boy took the following provisions for 2 days:

$1\frac{1}{3}$ lb. of flour	$\frac{1}{4}$ lb. of cocoa
$2\frac{1}{4}$ lb. of bacon	$\frac{3}{4}$ lb. of sugar

How much flour did each boy use each day?

Hint: Change $1\frac{1}{3}$ to an improper fraction.

7. How much bacon did each boy use each day?
8. How much cocoa did each boy use per meal if he used cocoa for four meals in the 2 days?
9. Each boy used only $\frac{2}{3}$ of his sugar in the two days. How much sugar did he use each day?
10. Coal is \$12 a ton. What will $\frac{7}{8}$ of a ton cost?
11. Harlan was to receive \$2 for 8 hours of work in a neighbor's garden. It rained and he worked only 6 hours. What part of the 8 hours did he work? How much pay should he receive?
12. The fifth-grade class has 36 pupils. They planned to have every pupil present at a school picnic, but only 30 came. What part of the entire class was at the picnic? What part was absent?
13. School closes at 11:30 and begins at 1:00. Harry requires 10 minutes each way in going and returning for lunch. He spends 20 minutes eating. What part of the noon has he left for play?
14. A taxi driver agreed to make the trip of 28 miles from Greenburg to Newcastle for \$7. His car broke down at Old Town, 7 miles from Newcastle. What part of the trip had been covered? How much pay should he receive if his passengers pay in proportion to the distance?



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Speed and Accuracy Practice

Find the products at your best speed, but look out for accuracy. Express all answers in lowest terms:

- | | | |
|-----------------------------|------------------------------|------------------------------|
| 1. $\frac{3}{4} \times 8$ | 11. $\frac{1}{3} \times 6$ | 21. $\frac{2}{3} \times 9$ |
| 2. $\frac{5}{8} \times 7$ | 12. $\frac{3}{5} \times 8$ | 22. $\frac{9}{10} \times 7$ |
| 3. $\frac{5}{6} \times 15$ | 13. $\frac{1}{8} \times 16$ | 23. $\frac{3}{4} \times 13$ |
| 4. $\frac{3}{5} \times 10$ | 14. $\frac{3}{4} \times 15$ | 24. $\frac{4}{5} \times 17$ |
| 5. $\frac{2}{3} \times 14$ | 15. $\frac{5}{12} \times 16$ | 25. $\frac{7}{8} \times 21$ |
| 6. $\frac{5}{6} \times 12$ | 16. $\frac{1}{4} \times 3$ | 26. $\frac{3}{16} \times 35$ |
| 7. $\frac{1}{4} \times 25$ | 17. $\frac{1}{2} \times 18$ | 27. $\frac{8}{25} \times 19$ |
| 8. $\frac{1}{2} \times 18$ | 18. $\frac{5}{16} \times 12$ | 28. $\frac{7}{4} \times 26$ |
| 9. $\frac{6}{7} \times 5$ | 19. $\frac{2}{3} \times 24$ | 29. $\frac{18}{5} \times 42$ |
| 10. $\frac{3}{8} \times 36$ | 20. $\frac{4}{9} \times 16$ | 30. $\frac{11}{2} \times 18$ |

4. Multiplying a Fraction by a Fraction.

Cut from paper a rectangle 8 inches long and 4 inches wide. Fold it with the crease the long way.

Fold again with the crease the short way. Unfold.

What is $\frac{1}{2}$ of $\frac{1}{2}$?

Now fold the paper again as it was. Then fold it once more with the crease the short way. Unfold.

What is $\frac{1}{2}$ of $\frac{1}{4}$?

Draw lines with your rule to show each of the following, and find the answer to each:

- $\frac{1}{2}$ of $\frac{1}{3}$ of a line that is 6 inches long.
- $\frac{1}{4}$ of $\frac{1}{2}$ of a line that is 8 inches long.
- $\frac{1}{2}$ of $\frac{1}{5}$ of a line that is 10 inches long.

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What is the answer to each of the following?

4. $\frac{1}{2}$ of $\frac{1}{6}$

8. $\frac{1}{5}$ of $\frac{1}{3}$

12. $\frac{1}{5}$ of $\frac{1}{8}$

16. $\frac{1}{3}$ of $\frac{1}{10}$

5. $\frac{1}{5}$ of $\frac{1}{4}$

9. $\frac{1}{2}$ of $\frac{1}{8}$

13. $\frac{1}{4}$ of $\frac{1}{6}$

17. $\frac{1}{3}$ of $\frac{1}{8}$

6. $\frac{1}{3}$ of $\frac{1}{2}$

10. $\frac{1}{2}$ of $\frac{1}{10}$

14. $\frac{1}{4}$ of $\frac{1}{3}$

18. $\frac{1}{3}$ of $\frac{1}{5}$

7. $\frac{1}{8}$ of $\frac{1}{5}$

11. $\frac{1}{2}$ of $\frac{1}{5}$

15. $\frac{1}{4}$ of $\frac{1}{5}$

19. $\frac{1}{3}$ of $\frac{1}{6}$

To multiply a fraction by a fraction, multiply the numerators together for a new numerator and the denominators for a new denominator.

Instead of writing $\frac{1}{4}$ of $\frac{1}{2}$ we can write $\frac{1}{4} \times \frac{1}{2}$. If we write it the second way, we still read the sign $\times$, *of*. These examples show what is meant.

1. $\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$

2. $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

3. $\frac{1}{3} \times \frac{1}{5} = \frac{1}{15}$

Find the products and do as many as you can without pencil.
State the answer in lowest terms:

1. $\frac{2}{3} \times \frac{4}{5}$

9. $\frac{7}{12} \times \frac{5}{6}$

17. $\frac{9}{20} \times \frac{6}{25}$

2. $\frac{1}{6} \times \frac{5}{8}$

10. $\frac{9}{10} \times \frac{11}{12}$

18. $\frac{1}{8} \times \frac{7}{8}$

3. $\frac{3}{8} \times \frac{4}{5}$

11. $\frac{15}{16} \times \frac{2}{3}$

19. $\frac{11}{3} \times \frac{3}{2}$

4. $\frac{5}{16} \times \frac{3}{4}$

12. $\frac{3}{5} \times \frac{18}{5}$

20. $\frac{125}{12} \times \frac{12}{25}$

5. $\frac{2}{9} \times \frac{7}{8}$

13. $\frac{24}{25} \times \frac{3}{4}$

21. $\frac{7}{16} \times \frac{16}{7}$

6. $\frac{1}{2} \times \frac{5}{6}$

14. $\frac{16}{45} \times \frac{4}{3}$

22. $\frac{3}{50} \times \frac{25}{2}$

7. $\frac{8}{15} \times \frac{3}{5}$

15. $\frac{7}{12} \times \frac{11}{12}$

23. $\frac{5}{9} \times \frac{11}{12}$

8. $\frac{4}{7} \times \frac{1}{4}$

16. $\frac{3}{75} \times \frac{54}{5}$

24. $\frac{7}{100} \times \frac{1}{10}$

Problems

1. Mary bought $\frac{3}{4}$ of a yard of ribbon for her mother. Her mother gave Mary $\frac{1}{3}$ of the ribbon. What part of a yard was Mary given?
2. John's father let him plant $\frac{2}{3}$ of an acre. John planted half of his ground to potatoes and half to cabbages. What part of an acre was planted to each vegetable?
3. Jane wishes to make a cake half the size of the one provided by the recipe. The recipe says $\frac{1}{2}$ of a pound of raisins. What quantity of raisins should Jane use?
4. A tin cup holds $\frac{5}{6}$ of a quart. What part of a quart is in it when it is $\frac{1}{4}$ full?
5. Five boys were in a bicycle race to see which one could be first to reach the spring, which was $\frac{3}{4}$ of a mile from Fred's farm. After they had been going a little while it rained. Fred had gone $\frac{1}{2}$ the distance to the spring, Charles had gone $\frac{2}{3}$, Ray had gone $\frac{6}{7}$, George had gone $\frac{4}{5}$ and Harold had gone $\frac{3}{4}$. What part of a mile had each gone?



6. A recipe for a cake calls for the following materials:
 $\frac{1}{2}$ cup butter $1\frac{1}{2}$ cup flour $\frac{1}{4}$ cup sugar
Find amount of each required for $\frac{1}{3}$ full recipe.

7. In preparing for a hike the boys found that each person should carry these amounts for a four days' trip:

$2\frac{2}{3}$ lb. flour

1 lb. condensed milk

$4\frac{1}{2}$ lb. bacon

$1\frac{1}{2}$ lb. sugar

How much of each article should each boy carry for a two days' hike?

8. Five girls bought $\frac{2}{3}$ yard of ribbon each. Mary used $\frac{1}{2}$ of hers, Edith used $\frac{1}{5}$ of hers, Frances used $\frac{5}{6}$ of hers, Ruth used $\frac{2}{3}$ of hers and Lucy used $\frac{3}{4}$ of hers. What part of a yard did each girl use?

Speed and Accuracy Practice

Try for a speed and accuracy record on these multiplications. Do the list again after several days for an improved record. If your record fails to improve, your teacher will give you more drill.

If the product is an improper fraction, express it as a mixed number:

9. $\frac{4}{5} \times \frac{5}{6}$

18. $\frac{5}{6} \times \frac{3}{8}$

27. $\frac{4}{5} \times \frac{10}{11}$

10. $\frac{5}{8} \times \frac{7}{8}$

19. $\frac{4}{3} \times \frac{7}{6}$

28. $\frac{5}{12} \times \frac{9}{16}$

11. $\frac{2}{3} \times \frac{3}{5}$

20. $\frac{3}{4} \times \frac{5}{6}$

29. $\frac{1}{2} \times \frac{9}{10}$

12. $\frac{3}{4} \times \frac{3}{7}$

21. $\frac{5}{2} \times \frac{3}{4}$

30. $\frac{8}{9} \times \frac{13}{8}$

13. $\frac{2}{5} \times \frac{3}{4}$

22. $\frac{4}{5} \times \frac{3}{4}$

31. $\frac{3}{10} \times \frac{2}{3}$

14. $\frac{2}{3} \times \frac{1}{2}$

23. $\frac{3}{2} \times \frac{8}{9}$

32. $\frac{5}{7} \times \frac{9}{11}$

15. $\frac{9}{8} \times \frac{2}{5}$

24. $\frac{5}{6} \times \frac{5}{4}$

33. $\frac{2}{3} \times \frac{8}{15}$

16. $\frac{6}{5} \times \frac{1}{3}$

25. $\frac{7}{8} \times \frac{6}{7}$

34. $\frac{1}{4} \times \frac{1}{25}$

17. $\frac{1}{2} \times \frac{7}{8}$

26. $\frac{7}{16} \times \frac{16}{7}$

35. $\frac{9}{16} \times \frac{8}{5}$

36. $\frac{5}{12} \times \frac{6}{7}$

37. $\frac{8}{9} \times \frac{2}{3}$

38. $\frac{7}{15} \times \frac{3}{4}$

39. $\frac{5}{11} \times \frac{7}{12}$

40. $\frac{11}{16} \times \frac{7}{8}$

41. $\frac{1}{14} \times \frac{5}{6}$

42. $\frac{2}{3} \times \frac{1}{25}$

43. $\frac{5}{8} \times \frac{1}{8}$

44. $\frac{3}{5} \times \frac{1}{13}$

45. $\frac{7}{12} \times \frac{8}{9}$

46. $\frac{25}{36} \times \frac{14}{15}$

47. $\frac{32}{35} \times \frac{5}{6}$

48. $\frac{11}{16} \times \frac{54}{55}$

49. $\frac{15}{17} \times \frac{17}{15}$

50. $\frac{13}{27} \times \frac{9}{2}$

5. Dividing a Fraction or a Mixed Number by an Integer.

What is $18 \div 3$? What is $\frac{1}{3}$ of 18?

Is $18 \div 3$ the same as $\frac{1}{3}$ of 18?

Is $24 \div 4$ the same as $\frac{1}{4}$ of 24?

Is $32 \text{ automobiles} \div 8$ the same as $\frac{1}{8}$ of 32 automobiles?

Is $\frac{1}{2}$ of an orange $\div 4$ the same as $\frac{1}{4}$ of $\frac{1}{2}$ an orange?

Complete these statements:

$\frac{1}{5} \text{ yd.} \div 3$ is the same as _____.

$\frac{2}{3} \text{ yd.} \div 2$ is the same as _____.

$\$ \frac{3}{4} \div 5$ is the same as _____.

$\frac{1}{8} \text{ bu.} \div 7$ is the same as _____.

$\frac{2}{9} \text{ bbl.} \div 4$ is the same as _____.

A fraction may be divided by a whole number by multiplying the denominator by that number.

1. What is $\frac{3}{5}$ of a gallon $\div 3$?

$$\frac{1}{3} \text{ of } \frac{3}{5} = \frac{3}{15} \text{ or } \frac{1}{5}$$

2. What is $\frac{4}{5}$ of a yard $\div 2$?

$$\frac{1}{2} \text{ of } \frac{4}{5} = \frac{4}{10} \text{ or } \frac{2}{5}$$

In each of these two examples we may divide the numerator of the fraction by the whole number instead of multiplying its denominator.

What is $\frac{9}{16}$ of a pound $\div 3$? $\frac{9}{16}$ of a pound $\div 2$?

What is $\frac{4}{5}$ of an acre $\div 4$? $\frac{4}{5}$ of an acre $\div 3$?

What is $\frac{6}{20}$ of a cord $\div 2$? $\frac{6}{20}$ of a cord $\div 4$?

To divide a fraction by a whole number, either divide the numerator of the fraction by that number or multiply the denominator by it. It is better to divide the numerator when this can be done without a remainder.

Perform these divisions by dividing the numerator by the whole number:

1. $\frac{9}{16} \div 3$

7. $\frac{10}{11} \div 5$

13. $\frac{18}{25} \div 9$

2. $\frac{8}{15} \div 4$

8. $\frac{16}{9} \div 4$

14. $\frac{144}{27} \div 12$

3. $\frac{12}{17} \div 6$

9. $\frac{24}{25} \div 6$

15. $\frac{200}{7} \div 10$

4. $\frac{14}{15} \div 7$

10. $\frac{5}{7} \div 5$

16. $\frac{288}{3} \div 24$

5. $\frac{21}{25} \div 3$

11. $\frac{84}{17} \div 12$

17. $\frac{512}{5} \div 16$

6. $\frac{36}{17} \div 9$

12. $\frac{35}{36} \div 5$

18. $\frac{1000}{9} \div 25$

Perform these divisions by multiplying the denominator by the whole number:

19. $\frac{7}{8} \div 3$

24. $\frac{5}{4} \div 4$

29. $\frac{17}{8} \div 2$

20. $\frac{9}{10} \div 5$

25. $\frac{15}{16} \div 9$

30. $\frac{12}{3} \div 5$

21. $\frac{12}{25} \div 7$

26. $\frac{13}{2} \div 8$

31. $\frac{14}{20} \div 6$

22. $\frac{1}{8} \div 4$

27. $\frac{7}{12} \div 6$

32. $\frac{2}{1} \div 4$

23. $\frac{17}{6} \div 3$

28. $\frac{13}{25} \div 10$

33. $\frac{5}{32} \div 3$

Perform these divisions. Divide the numerator when you can:

34. $\frac{1\frac{2}{6}}{16} \div 3$

39. $\frac{7}{16} \div 4$

44. $\frac{9}{10} \div 3$

35. $\frac{3}{7} \div 2$

40. $\frac{2\frac{4}{5}}{5} \div 5$

45. $\frac{3}{5} \div 10$

36. $\frac{1\frac{5}{9}}{9} \div 3$

41. $\frac{7}{8} \div 7$

46. $\frac{2\frac{5}{5}}{5} \div 5$

37. $\frac{2\frac{4}{6}}{6} \div 6$

42. $\frac{1\frac{4}{2}\frac{4}{4}}{24} \div 12$

47. $\frac{6\frac{3}{8}}{8} \div 4$

38. $\frac{1\frac{1}{2}}{12} \div 12$

43. $\frac{100}{8} \div 8$

48. $\frac{5\frac{4}{6}}{16} \div 12$

Problems

1. Jamie's mother had $\frac{1}{3}$ of a watermelon in the refrigerator. She served this as a treat to Jamie and three of his friends. What part of the whole melon did each receive?
2. Mary served $\frac{3}{4}$ of a pie to 4 girls. What part of the whole pie did each receive?
3. Mr. Brown has $\frac{5}{8}$ of an acre of ground near the school-house which he will allow the school to use for a school garden. If the ground is divided into 10 equal plots, what part of an acre will each contain? How many square rods will each plot contain? (There are 160 square rods in an acre.)
4. The fifth-grade children bought $2\frac{2}{3}$ bushels of potatoes to be given to poor families at Thanksgiving. The children wanted to divide the potatoes equally among four families. How much should each family receive?

$$2\frac{2}{3} \div 4 = ?$$

$$2\frac{2}{3} = \frac{8}{3}$$

$$\frac{8}{3} \div 4 = \frac{1}{4} \times \frac{8}{3}$$

$$\frac{1}{4} \times \frac{8}{3} = \frac{8}{12} \text{ or } \frac{2}{3}$$

Therefore each family should receive $\frac{2}{3}$ of a bushel.

To divide a mixed number by a whole number, change the mixed number to an improper fraction and proceed as in dividing any fraction.

5. Here is a recipe for cookies:

Sugar $1\frac{1}{2}$ cups

Milk $\frac{3}{4}$ cup

Butter $\frac{1}{2}$ cup

Flour $3\frac{1}{2}$ cups

Eggs 2

Write this recipe for half the quantities called for.

6. Write this recipe for fudge for $\frac{1}{3}$ the quantities called for:

Sugar 6 cups

Butter $1\frac{1}{2}$ table spoons

Water $1\frac{1}{2}$ cups

Chocolate 3 squares

Milk $2\frac{1}{4}$ cups

7. In a relay race $\frac{5}{8}$ of a mile was covered by 4 runners. What fraction of a mile did each cover?
8. John covered $14\frac{3}{4}$ feet in three jumps. How many feet did he average for each jump?
- Hint: First change the mixed number to an improper fraction.
9. Mary had $3\frac{3}{4}$ pounds of butter which she divided into 5 equal pieces. What did each piece weigh?
10. The three Smith children spent the day gathering walnuts and came home with $2\frac{1}{4}$ bushels which they divided equally among themselves. What part of a bushel did each child have?
11. Lucile has $1\frac{3}{4}$ yards of ribbon which she plans to divide equally among her three dolls. What part of a yard will each doll have?

Exercises

Find the quotients. Work as fast as you can, but get them right.

1. $\frac{5}{12} \div 4$

7. $\frac{1}{11} \div 11$

13. $\frac{5}{4} \div 5$

2. $\frac{8}{9} \div 2$

8. $\frac{16}{17} \div 8$

14. $\frac{27}{28} \div 7$

3. $\frac{16}{25} \div 4$

9. $\frac{5}{44} \div 11$

15. $\frac{84}{25} \div 5$

4. $\frac{11}{13} \div 5$

10. $\frac{125}{12} \div 12$

16. $\frac{9}{12} \div 3$

5. $\frac{18}{27} \div 6$

11. $\frac{3}{4} \div 6$

17. $\frac{13}{14} \div 14$

6. $\frac{5}{36} \div 6$

12. $\frac{2}{1} \div 2$

18. $\frac{2}{3} \div 8$

6. Dividing an Integer by a Fraction.

In the following problems supply the right numbers:

1. In \$8 there are _____ \$4's

2. In \$8 there are _____ \$2's

3. In \$8 there are _____ \$1's

4. In \$8 there are _____ $\frac{1}{2}$'s

5. In \$8 there are _____ $\frac{1}{4}$'s

6. In \$8 there are _____ $\frac{1}{8}$'s

7. 6 inches = _____ 3 in.

8. 6 inches = _____ 2 in.

9. 6 inches = _____ 1 in.

10. 6 inches = _____ $\frac{1}{2}$ in.

11. 6 inches = _____ $\frac{1}{4}$ in.

12. 6 inches = _____ $\frac{1}{5}$ in.

13. 12 yd. $\div$ 6 = _____ yd.

14. 12 yd. $\div$ 4 = _____ yd.

15. 12 yd. $\div$ 3 = _____ yd.

16. 12 yd. $\div$ $\frac{1}{2}$ = _____ yd.

17. $12 \text{ yd.} \div \frac{1}{3} = \text{_____ yd.}$

18. $12 \text{ yd.} \div \frac{1}{6} = \text{_____ yd.}$

19. $2 \text{ acres} = \text{_____} \frac{1}{2} \text{ acre lots}$

20. $2 \text{ acres} = \text{_____} \frac{1}{4} \text{ acre lots}$

21. $2 \text{ acres} = \text{_____} \frac{1}{8} \text{ acre lots}$

22. $2 \text{ acres} = \text{_____} \frac{1}{6} \text{ acre lots}$

23. $2 \text{ acres} = \text{_____} \frac{1}{12} \text{ acre lots}$

24. $2 \text{ acres} = \text{_____} \frac{1}{16} \text{ acre lots}$

The reciprocal of a number is 1 divided by that number.

2 is the reciprocal of $\frac{1}{2}$.

5 is the reciprocal of $\frac{1}{5}$.

3 is the reciprocal of $\frac{1}{3}$.

6 is the reciprocal of $\frac{1}{6}$.

4 is the reciprocal of $\frac{1}{4}$.

7 is the reciprocal of $\frac{1}{7}$.

The reciprocal of a fraction is that fraction with its numerator and denominator interchanged.

$\frac{3}{2}$ is the reciprocal of $\frac{2}{3}$.

$\frac{5}{4}$ is the reciprocal of $\frac{4}{5}$.

$\frac{2}{1}$ is the reciprocal of $\frac{1}{2}$.

$\frac{7}{8}$ is the reciprocal of $\frac{8}{7}$.

12 is the reciprocal of $\frac{1}{12}$.

$\frac{4}{3}$ is the reciprocal of $\frac{3}{4}$.

Give the reciprocal of each of these fractions:

1. $\frac{3}{8}$

4. $\frac{2}{9}$

7. $\frac{1}{8}$

2. $\frac{5}{6}$

5. $\frac{7}{12}$

8. $\frac{3}{16}$

3. $\frac{5}{3}$

6. $\frac{8}{5}$

9. $\frac{2}{25}$

To divide by any number, you may multiply by its reciprocal.

Compare the result of $12 \div 3$, with the result of $\frac{1}{3} \times 12$.

Compare the result of $16 \div 8$, with the result of $\frac{1}{8} \times 16$.

Compare the result of $10 \div 2$, with the result of $\frac{1}{2} \times 10$.

In solving these problems perform the divisions by multiplying by the reciprocals of the fractions.

1. How many pieces of ribbon $\frac{2}{3}$ of a yard long can be cut from a piece that has 8 yards in it?
2. If a shelf is 36 inches long, how many books $\frac{9}{10}$ of an inch thick will it hold?
3. If a newsboy pays $\frac{4}{5}$ of a cent for a newspaper, how many can he buy for 60 cents?
4. James was drawing a floor plan to a scale. One foot was represented by $\frac{3}{4}$ of an inch. How many feet would be represented by 9 inches on the drawing?
5. Mary had a piece of leather 27 inches wide. She wished to cut it into strips $\frac{3}{4}$ of an inch wide for book marks. How many could she cut?
6. How many $\frac{3}{4}$ -acre lots can be cut from 15 acres of land?
7. If a horse eats $\frac{3}{8}$ of a bushel of oats per day, how many days will 12 bushels last?
8. How many glass marbles at $\frac{7}{8}$ of a cent each can be bought for 21 cents?
9. How many pieces of candy weighing $\frac{1}{4}$ of an ounce each in 1 pound of candy?
10. If on a map $\frac{3}{4}$ of an inch represents a mile, how many miles are represented by 9 inches?
11. How many scarfs $\frac{7}{8}$ of a yard long can be cut from a piece of linen 14 yards long?

Exercises

Answer as fast as you can, without pencil:

How many $\frac{1}{3}$'s in 6?

How many $\frac{1}{8}$'s in 6?

How many $\frac{1}{5}$'s in 10?

How many $\frac{1}{9}$'s in 3?

How many $\frac{1}{2}$'s in 18?

How many $\frac{1}{6}$'s in 5?

How many $\frac{1}{4}$'s in 8?

How many $\frac{1}{10}$'s in 4?

Perform these divisions by multiplying by the reciprocals of the fractions, and express the answers as whole or mixed numbers. *Check your answers by multiplying:*

12. $6 \div \frac{1}{3}$

18. $9 \div \frac{2}{3}$

24. $90 \div \frac{1}{3}$

13. $10 \div \frac{3}{5}$

19. $13 \div \frac{1}{4}$

25. $26 \div \frac{3}{4}$

14. $18 \div \frac{1}{2}$

20. $27 \div \frac{1}{3}$

26. $54 \div \frac{3}{8}$

15. $12 \div \frac{3}{8}$

21. $11 \div \frac{3}{4}$

27. $1 \div \frac{2}{5}$

16. $16 \div \frac{3}{4}$

22. $25 \div \frac{6}{7}$

28. $100 \div \frac{5}{8}$

17. $18 \div \frac{1}{5}$

23. $50 \div \frac{1}{3}$

29. $84 \div \frac{1}{2}$

7. Dividing a Fraction by a Fraction.

You have learned (page 99) that *to divide an integer by a fraction you may multiply the integer by the reciprocal of the fraction.*

A fraction may be divided by a fraction in the same way.

What is $\frac{3}{4} \div \frac{1}{2}$?

$\frac{3}{4} \div \frac{1}{2}$ is the same as $\frac{3}{4} \times \frac{2}{1}$

$\frac{3}{4} \times \frac{2}{1} = \frac{6}{4}$, or $1\frac{1}{2}$

To divide a fraction by a fraction invert the divisor (this gives its reciprocal) and multiply.

Perform these divisions:

1. $\frac{2}{3} \div \frac{3}{4}$

9. $\frac{4}{5} \div \frac{1}{12}$

17. $1\frac{1}{2} \div \frac{3}{4}$

2. $\frac{5}{6} \div \frac{2}{3}$

10. $\frac{5}{16} \div \frac{3}{32}$

18. $\frac{22}{7} \div \frac{1}{7}$

3. $\frac{1}{2} \div \frac{1}{3}$

11. $\frac{1}{5} \div \frac{1}{10}$

19. $\frac{1}{16} \div \frac{1}{2}$

4. $\frac{3}{5} \div \frac{5}{6}$

12. $\frac{3}{50} \div \frac{7}{8}$

20. $\frac{9}{10} \div \frac{3}{10}$

5. $\frac{5}{8} \div \frac{4}{9}$

13. $\frac{9}{25} \div \frac{6}{7}$

21. $\frac{9}{8} \div \frac{1}{6}$

6. $\frac{3}{10} \div \frac{3}{5}$

14. $\frac{23}{8} \div \frac{4}{5}$

22. $\frac{43}{50} \div \frac{2}{3}$

7. $\frac{3}{4} \div \frac{3}{5}$

15. $\frac{7}{9} \div \frac{3}{9}$

23. $\frac{9}{40} \div \frac{35}{3}$

8. $\frac{6}{7} \div \frac{5}{6}$

16. $\frac{4}{7} \div \frac{7}{4}$

24. $1\frac{7}{25} \div \frac{35}{7}$

What is $2\frac{1}{4} \div \frac{2}{3}$?

$$2\frac{1}{4} = \frac{9}{4}$$

$$\frac{9}{4} \div \frac{2}{3} = \frac{27}{8}, \text{ or } 3\frac{3}{8}$$

What is $\frac{3}{4} \div 2\frac{1}{2}$?

$$2\frac{1}{2} = \frac{5}{2}$$

$$\frac{3}{4} \div \frac{5}{2} = \frac{6}{20}, \text{ or } \frac{3}{10}$$

To divide when either dividend or divisor is a mixed number, change the mixed number to an improper fraction and proceed with the division.

Find the quotients:

25. $3\frac{2}{3} \div \frac{3}{4}$

29. $\frac{3}{5} \div 1\frac{3}{4}$

26. $\frac{5}{6} \div \frac{17}{8}$

30. $8\frac{1}{3} \div \frac{5}{8}$

27. $12\frac{5}{6} \div \frac{3}{10}$

31. $6\frac{1}{2} \div 2\frac{1}{3}$

28. $\frac{3}{26} \div 2\frac{1}{2}$

32. $12\frac{2}{5} \div 6\frac{3}{4}$

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33. $11\frac{5}{12} \div \frac{5}{6}$

37. $5\frac{3}{7} \div 8\frac{1}{5}$

34. $\frac{3}{4} \div 1\frac{2}{3}$

38. $\frac{3}{16} \div 5\frac{1}{3}$

35. $\frac{5}{8} \div 4\frac{3}{8}$

39. $5\frac{1}{3} \div 1\frac{3}{8}$

36. $13\frac{1}{2} \div 1\frac{3}{16}$

40. $7\frac{5}{6} \div 1\frac{2}{3}$

Write the answers to these at sight:

41. $\frac{5}{7} \div \frac{2}{3}$

47. $\frac{3}{10} \div \frac{4}{5}$

42. $\frac{7}{16} \div \frac{5}{4}$

48. $\frac{5}{12} \div \frac{6}{7}$

43. $\frac{3}{5} \div \frac{3}{8}$

49. $\frac{2}{3} \div \frac{5}{9}$

44. $\frac{9}{10} \div \frac{3}{5}$

50. $\frac{7}{8} \div \frac{3}{8}$

45. $\frac{8}{9} \div \frac{5}{6}$

51. $\frac{1}{2} \div \frac{1}{4}$

46. $\frac{3}{8} \div \frac{3}{4}$

52. $\frac{1}{12} \div \frac{1}{9}$

Problems

1. Joe's mother had $\frac{2}{3}$ of a pie which she cut so each person had $\frac{1}{6}$ of a pie. How many pieces did she make?
2. How many strips of carpet $\frac{2}{3}$ of a yard wide will cover a room $4\frac{2}{3}$ yards wide?
3. Mary had $1\frac{7}{8}$ pounds of sweet-pea seed from her garden. She put these up in packages of $\frac{3}{16}$ of a pound each. How much did she receive for them at 10 cents a package?
4. John works on a farm. He has a field of $15\frac{1}{2}$ acres to plow. If he can plow $2\frac{3}{4}$ acres a day how many days will he need to plow the field?
5. Frank needs 8 boards, each $1\frac{1}{2}$ feet long. Can he cut these from a board 12 feet long?

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6. Mr. Smith raised $75\frac{1}{2}$ bushels of corn on $2\frac{1}{2}$ acres. What was the yield per acre?
7. The fifth-grade girls want to make some towels, each to be $\frac{2}{3}$ of a yard long. They have $8\frac{2}{3}$ yards of toweling. How many towels can they make?
8. Two fractions multiplied together give $\frac{9}{20}$. One of the fractions is $\frac{3}{5}$. What is the other?
9. The product of two numbers is $16\frac{2}{3}$. One of the numbers is $3\frac{1}{2}$. What is the other?
10. How many strips $2\frac{1}{2}$ inches wide can be sawed from a board $12\frac{1}{2}$ inches wide, no allowance being made for waste in sawing?
11. On a picket fence each picket with the space between it and the next picket, covers $5\frac{1}{2}$ inches. How many pickets will be required to each rod of fence? (1 rod = $16\frac{1}{2}$ feet.)
12. If each course of brick with the mortar in a wall measures $2\frac{1}{2}$ inches, how many courses are required to build a wall 10 feet high?
13. Josephine measured the sherbet she made for her party and found she had $12\frac{1}{2}$ pints. How many $\frac{1}{2}$ -pint glasses can be filled?
14. Ruth's mother was giving a party. She had a package of butter weighing $12\frac{1}{2}$ ounces which she asked Ruth to cut up into squares that weighed $\frac{5}{12}$ of an ounce each. How many squares were there?
15. Ralph was reading a story book of 260 pages. He read at the rate of $\frac{7}{8}$ page a minute. At this rate how many hours would it take him to read the book? First find how many minutes.

Practice for Speed and Accuracy

Perform these divisions as rapidly as you can, but try to get every one right. See how many you can get right in 5 minutes.

1. $\frac{5}{8} \div \frac{2}{3}$

11. $\frac{1\frac{1}{2}}{1\frac{2}{3}} \div \frac{6}{7}$

21. $28 \div 4\frac{1}{2}$

2. $\frac{5}{6} \div \frac{3}{4}$

12. $\frac{4}{1\frac{5}{8}} \div \frac{2}{3}$

22. $54 \div 6\frac{2}{3}$

3. $\frac{3}{5} \div \frac{2}{7}$

13. $\frac{2}{9} \div \frac{2}{7}$

23. $18 \div 4\frac{1}{2}$

4. $\frac{3}{16} \div \frac{2}{9}$

14. $3\frac{1}{2} \div \frac{1}{4}$

24. $24 \div 1\frac{1}{8}$

5. $\frac{1}{3} \div \frac{3}{4}$

15. $4\frac{1}{4} \div \frac{1}{5}$

25. $2\frac{5}{16} \div 1\frac{3}{8}$

6. $\frac{7}{8} \div \frac{1}{4}$

16. $6\frac{2}{3} \div \frac{5}{8}$

26. $7 \div 8\frac{2}{3}$

7. $\frac{1}{6} \div \frac{2}{3}$

17. $\frac{3}{5} \div 2\frac{1}{2}$

27. $5 \div 15\frac{1}{5}$

8. $\frac{1}{4} \div \frac{5}{9}$

18. $10\frac{3}{4} \div 1\frac{1}{3}$

28. $\frac{1}{3} \div 3\frac{1}{9}$

9. $\frac{3}{4} \div 1\frac{1}{2}$

19. $6\frac{3}{4} \div 2\frac{1}{8}$

29. $\frac{9}{8} \div 3\frac{1}{2}$

10. $\frac{1\frac{5}{6}}{1\frac{5}{8}} \div \frac{5}{8}$

20. $1\frac{1}{3} \div 3$

30. $1 \div 2\frac{1}{2}$

8. Problems with Fractions.

1. A class at school chose purple and white for its colors. The committee bought 12 yards of ribbon of each color, which they cut in pieces $\frac{3}{8}$ of a yard long. How many badges did it make?
2. Mary used $\frac{1}{9}$ of a square yard of linen to make a handkerchief. How many could she make from 4 yards?
3. Jelly is put into jars holding $\frac{3}{4}$ of a pint. How many jars are required to hold 9 pints?
4. John's chickens eat $\frac{2}{3}$ of a pound of grain each day. At this rate how many days does a bushel of grain weighing 60 pounds last?

5. Robert made a book-shelf $\frac{5}{6}$ of a yard long. How many book-shelves could he make from a piece of lumber 5 yards long?
6. Dorothy made sash curtains out of flowered cretonne for her playroom. If each curtain was $\frac{4}{5}$ of a yard long, how many curtains could she make from 8 yards?
7. It requires $\frac{7}{8}$ of a yard of linen to make 1 towel. How many towels can be made from 14 yards?
8. At the rate of $\frac{2}{5}$ of a mile per minute, how many minutes does it take a train to go 20 miles?
9. If Margaret feeds her cat $\frac{1}{4}$ of a pound of liver each day, how many days will 3 pounds last?
10. When oranges are $\frac{3}{5}$ of a dollar per dozen, how many dozen can be bought for $\$6\frac{3}{5}$?
11. How many $\frac{1}{4}$ -pound bricks of butter can be made from a 60-pound tub of butter?
12. If a restaurant serves $\frac{1}{4}$ of a pound of turkey to an order, how many orders will an 18-pound turkey fill?
13. James wishes to buy a \$30 bicycle. He saves $\$ \frac{3}{4}$ each week. How many weeks will he need to save?
14. Mr. Clark wishes to purchase an automobile for \$1000, which is $\frac{2}{5}$ of his yearly salary. How much does he receive a year?
15. Mr. Brown has a grocery and meat market. On a certain day, the sales in his meat market were \$256, which was $\frac{4}{5}$ of the sales in his grocery. How many dollars' worth of groceries did he sell?
16. Roy bought a radio set from a dealer for \$75. This was $\frac{5}{8}$ of the price asked by another dealer. Find the latter's price.

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17. On a hiking trip, some Camp Fire Girls walked 8 miles. This was $\frac{4}{5}$ of the distance a troupe of Boy Scouts hiked on the same day. How far did the Boy Scouts walk?
18. Alice received a mark of 84 in an arithmetic test. This was $\frac{7}{8}$ of the mark received by Helen. Find Helen's mark.
19. Maple Avenue has been repaved for a distance of 812 feet, which is $\frac{2}{3}$ of its entire length. How long is Maple Avenue?
20. John weighs 64 pounds. This is $\frac{4}{11}$ of his father's weight. How much does his father weigh?
21. For a Junior Red Cross sale, Nell made 10 boxes of candy, each box holding $\frac{3}{4}$ of a pound. How many pounds did she make?
22. Find the amount of the following bill:

ROCKFIELD, MASS.

May 11, 1925

Mrs. J. R. McConnon,
63 East Linn St.,

TO Inter State Mercantile Co., DR.

April 21 16 $\frac{1}{2}$ yd. silk @ 85¢

25 12 yd. lining @ 16 $\frac{2}{3}$ ¢

28 18 $\frac{1}{2}$ yd. braid @ 12¢

23. Find what your mother pays per pound for each of the following at the meat market:

Chicken	Sirloin steak
Pork Chops	Round steak
Pork roast (loin)	Rib roast
Bacon	Lamb chops (rib)
Ham	Leg of lamb

24. At the price charged in your market, find the cost of a chicken that weighs $2\frac{1}{4}$ lb.; $2\frac{1}{2}$ lb.; 3 lb.
25. Find the cost of a sirloin steak that weighs $1\frac{3}{4}$ lb.; $2\frac{1}{2}$ lb.; $2\frac{3}{4}$ lb.; $3\frac{1}{4}$ lb.
26. Find the cost of a round steak that weighs $4\frac{1}{2}$ lb.; $3\frac{1}{4}$ lb.; $1\frac{1}{2}$ lb.
27. Find the cost of a pork roast that weighs $2\frac{3}{4}$ lb.; $3\frac{1}{4}$ lb.; $5\frac{1}{2}$ lb.
28. A family of six ordered the following meat during one week:

Monday, sirloin steak	$2\frac{1}{2}$ lb.
Tuesday, leg of lamb	$3\frac{3}{4}$ lb.
Wednesday, pork chops	$1\frac{3}{4}$ lb.
Thursday, rib roast	$4\frac{1}{4}$ lb.
Friday, fish	$3\frac{1}{4}$ lb.
Saturday, round steak	$2\frac{1}{8}$ lb.
Sunday, chicken	$5\frac{1}{2}$ lb.

At the price in your local market what was the cost for the entire week?

29. How many $\frac{1}{2}$ -pint bottles of cream can be filled from $8\frac{1}{2}$ pints?

30. Mr. Smith has in his garage a can that holds 12 gallons of motor oil. His car requires $1\frac{1}{2}$ gallons to fill it. How many fillings can he get from his can of oil?

Review and Practice

Make your best record for speed and accuracy on this list:

1. $\frac{1}{2} + \frac{1}{4} + \frac{7}{8}$

6. $\frac{5}{3} - \frac{3}{4}$

2. $1\frac{2}{3} + 6\frac{1}{3} + 5\frac{5}{6}$

7. $\frac{11}{16} - \frac{1}{4}$

3. $\frac{7}{8} - \frac{3}{4}$

8. $\frac{7}{8} + \frac{2}{3} + \frac{5}{6}$

4. $5\frac{2}{3} - 3\frac{1}{6}$

9. $\frac{1}{2} + \frac{3}{4} + \frac{3}{5}$

5. $6\frac{7}{8} - 5\frac{1}{2}$

10. $\frac{1}{3} + \frac{1}{2} + \frac{1}{6}$

Find the answers to these in the least possible time. Accuracy is more important than speed, but work fast:

1. $\frac{7}{8}$ of 72

9. $11\frac{1}{2} \div 3\frac{2}{5}$

17. $25 \div 2\frac{1}{2}$

2. $\frac{3}{8} \div \frac{1}{2}$

10. $\frac{5}{6} \times 186$

18. $\frac{5}{6} \times \frac{5}{6}$

3. $\frac{5}{6} \times 12$

11. $124 \times \frac{3}{4}$

19. $\frac{5}{6} \div \frac{5}{6}$

4. $9 \times \frac{4}{5}$

12. $20\frac{2}{3} \div 2\frac{3}{4}$

20. $96\frac{2}{3} \div 12\frac{1}{2}$

5. $2\frac{3}{4} \div 6\frac{1}{2}$

13. $14\frac{2}{5} \times 12\frac{2}{3}$

21. $28\frac{2}{3} \times 14\frac{3}{8}$

6. $\frac{3}{16} \times \frac{3}{4}$

14. $3\frac{2}{3} \div \frac{2}{3}$

22. $\frac{7}{8} \div 4\frac{1}{2}$

7. $5\frac{3}{7} \times 8\frac{1}{4}$

15. $\frac{3}{4} \div \frac{3}{8}$

23. $68 \div 2\frac{3}{4}$

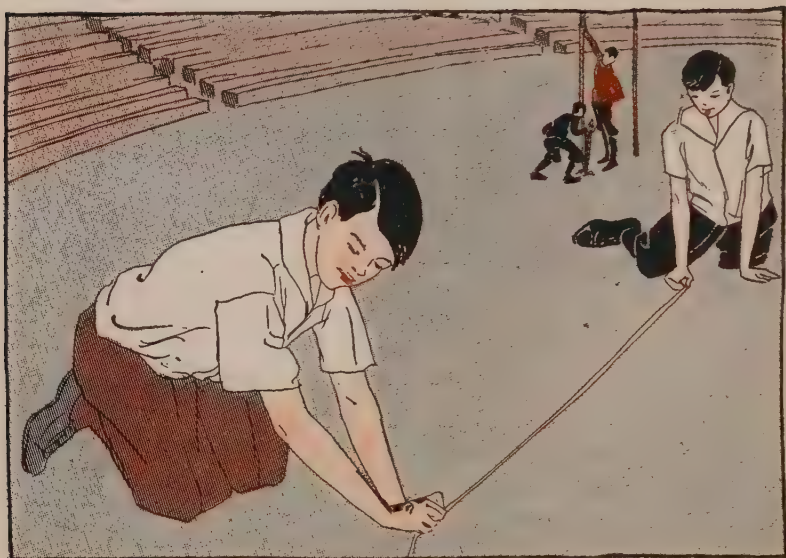
8. $\frac{5}{9} \times 12$

16. $2\frac{1}{4} \div \frac{3}{8}$

24. $24\frac{1}{8} \div \frac{1}{3}$

Are there any points on which you have special trouble in fractions? If so, your teacher will suggest review.

IV. COMMON MEASURES AND THEIR APPLICATION



1. Measures of Length.

The Roosevelt School was to have a track meet. The boys of the fifth grade were to measure distances for the 50-yard dash and the 100-yard dash. The sixth-grade boys were to put up standards to hold the pole for the high jump and to fix places for the running broad jump and the standing broad jump. All the jumps were measured in feet and inches.

They soon found that they needed to know the relation between inches, feet and yards, so they learned the following table:

Table of Measures of Length

$$12 \text{ in.} = 1 \text{ ft.}$$

$$3 \text{ ft.} = 1 \text{ yd.}$$

$$5\frac{1}{2} \text{ yd. or } 16\frac{1}{2} \text{ ft.} = 1 \text{ rd.}$$

$$320 \text{ rd. or } 5280 \text{ ft.} = 1 \text{ mi.}$$

1. Without using a ruler draw a line that you think is one inch long. Now measure this line.
2. How long do you think your arithmetic is? Measure it.
3. Is your desk more or less than a foot wide? Measure it.
4. Is the blackboard more or less than a yard high? Measure it.
5. Is your teacher's desk more or less than a yard long? Measure it.
6. How long is a new piece of chalk?
7. How long is an eraser? How wide is it?
How wide is your schoolroom? How long?
8. What unit of measurement is used in stores for measuring dress goods?
What unit of measurement is used in measuring fencing?
What unit is used in measuring distances between cities?
9. The school playground was 8 rods long and 7 rods wide. Give the dimensions in feet.
10. The running track around the playground measured 440 feet. How many times around this field would make a mile?
11. John could make 6 feet 2 inches in the running broad jump. James could make 8 feet 3 inches. How many inches farther could James jump?

12. Harry could make 4 feet 7 inches in the standing broad jump. His big brother could jump twice as far. How far could the brother jump?

13. The girls practised throwing the basket ball. Mary could throw it 32 feet 8 inches, but Elizabeth could throw it 3 feet 9 inches farther than Mary. How far could Elizabeth throw the ball?



14. A graduating class consisting of 32 members was given diplomas tied with ribbons. Each diploma required 17 inches of ribbon. How much did the ribbon cost at 12 cents a yard?
15. Which is the taller girl, Helen who is 57 inches or Sarah who is 4 feet 6 inches? How many inches taller?
16. The baseball diamond is 90 feet on each side. If a boy makes a home run how many yards does he run?
17. The swimming tank is 35 feet long and 25 feet wide. John swam the length of it 5 times. How many yards did he swim? James swam the width 8 times. How many yards did he swim?
18. What is the distance around the tank in feet? In yards?
19. William lives 12 blocks from school. Each block is about 280 feet long. He walks this distance four times a day. How many miles does he walk?
20. Find the distance in feet around a field $\frac{1}{4}$ of a mile long and $\frac{1}{6}$ of a mile wide.

21. Mary bought lace to edge a scarf 90 inches around. How many yards did she buy? How much did it cost at \$.18 per yard?
22. Mary bought cretonne for six pillows. Each pillow required 32 inches. How many yards did she buy?
23. Jane bought 4 yards of ribbon to make bags. Each bag required 18 inches of ribbon. How many bags could she make?
24. What fraction of a yard wide is material 27 inches wide? 30 inches wide? 32 inches wide?
25. A sidewalk is $22\frac{1}{2}$ yards long. Find its length in feet.
26. Find the cost of 54 inches of ribbon at \$.28 per yard.
27. The curtain for a certain window is 80 inches long. How many yards of material will be needed for 6 curtains, allowing 5 inches on each curtain for hems?
28. If the distance from the center of one railway tie to the center of the next is 2 feet, how many ties are used to the mile?
29. The distance between two lakes is $12\frac{3}{4}$ miles. Express the distance in miles and feet.
30. The speedometer on an automobile shows that the car has traveled $16\frac{3}{10}$ miles. This is how many feet more than 16 miles?
31. How many steps will a man take going a mile if each step measures $2\frac{1}{3}$ feet?
32. How many feet of picture molding are required to frame a picture 28 inches long and 18 inches wide? Use full length molding on each of the four sides.

Reduction, or Changing from One Measure to Another

How many inches in 3 feet?

$$3 \times 12 \text{ in.} = 36 \text{ in.}$$

How many feet in 8 yards? $8 \times 3 \text{ ft.} = 24 \text{ ft.}$

How many feet in 96 inches? $96 \text{ in.} \div 12 \text{ in.} = 8.$

How many miles in 15,840 feet?

$$15,840 \text{ ft.} \div 5,280 \text{ ft.} = 3.$$

Changing from higher to lower measures or from lower to higher measures is called **REDUCTION**.

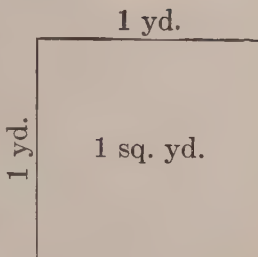
Exercises

1. Change $3\frac{1}{2}$ ft. to in.
2. Change 1 yd. 2 ft. to ft.
3. Change 196 in. to ft.
4. Change 1440 rd. to mi.
5. Change $2\frac{1}{2}$ mi. to ft.
6. Change 165 ft. to yd.
7. Change 7040 yd. to mi.
8. Change $1\frac{1}{2}$ mi. to in.
9. Change 126,720 in. to mi.
10. Change $25\frac{1}{2}$ rd. to yd.

2. Measures of Surface.

Kate and Alice had a play house that was 6 feet wide and 9 feet long. They found they could buy some used carpet to cover the floor. James and Herbert promised to get some felt roofing for the roof. The girls did not know how much carpet and the boys did not know how much roofing would be needed, so they all went to mother.

She told them that they would have to buy the carpet and the roofing by the square yard, and explained it by drawing a square on the ground 1 yard long on each side, like this: "This," she said, "has 1 square yard in it. You buy both carpet and roofing by the square yard."

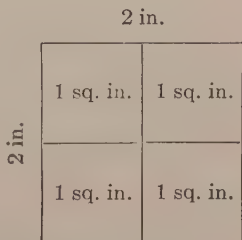


How wide was the floor in feet? In yards?

Draw a diagram of the floor, marking off the length and width in yards. Draw lines through the diagram to show the number of square yards in the floor. Multiply the length in yards by the width in yards. Compare this answer with the number of square yards you found in the drawing.

1. Draw a square whose sides are one inch long. How many square inches in it?
2. Draw a square whose sides are two inches long. Draw lines through it to show how many squares there are in it, whose sides are 1 inch, thus:

How many square inches are there in this square?



3. Draw a square whose sides are 3 inches long. How many square inches are in it? (If you can't tell, draw the lines through it and find out how many squares there are whose sides are 1 inch long.)

4. How many square inches in a square whose sides are 4 inches long? 6 inches? 8 inches? 5 inches?

5. Draw a square 1 foot long on each side. Mark off each side into inches as shown in the drawing and draw lines dividing the square into square inches.

How many square inches in one row on the side of the large square?

How many rows are there?

To find the number of square units in a surface multiply its length by its width.

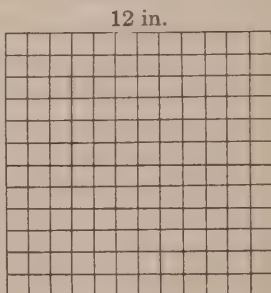


Table of Square Measure

144 sq. in. = 1 sq. ft.

9 sq. ft. = 1 sq. yd.

$30\frac{1}{4}$ sq. yd. = 1 sq. rd.

160 sq. rd. = 1 acre (1 A.)

Problems in Square Measure

6. How many square feet of floor space are there in your schoolroom?
7. Find the average number of square feet of floor space per pupil.

To find the average per pupil, divide the whole number of square feet by the whole number of pupils in the room.

8. If 16 square feet of floor space are allowed as the proper amount for each pupil, how many pupils should be seated in your room? (Use the total area of the room.)

9. How many square feet of window space are there in your room? If there is less than 1 square foot of window space for every 5 square feet of floor space, your room is not properly lighted.
10. What is the cost of the blackboard in your room at 18¢ per square foot?
11. Mr. Brooks has a lot 45 feet wide. He builds a 4-foot concrete sidewalk in front of his lot. What does it cost him at 35¢ a square foot?
12. Constance was sent to buy linoleum for her mother's kitchen, which was 8 feet wide and 12 feet long. How many square yards of linoleum were necessary?
13. A $9' \times 12'$ rug is placed in her mother's living-room, which is $12' \times 16'$. How much of the floor space remains uncovered? ($9' \times 12'$ means 9 feet by 12 feet.)
14. The dining-room of Constance's home is $11' \times 12'$. How much larger is the living-room than the dining-room?
15. A golf club buys a field 120 rods by 144 rods to be used as a golf course. How many acres are there in the field?
16. Roger has a small vegetable garden $15' \times 24'$. How many square feet are there in the garden?
17. His radish bed is 2 feet 6 inches by 8 feet. This is what fractional part of his garden?
18. His tomato patch is $6' \times 12'$. He allows 2 square feet of space per plant. How much will his plants cost him at 60¢ per dozen?
19. Constance plants a flower garden $4' \times 24'$. Find the area of her garden.

20. How long will it take her to spade her flower bed, if she can spade 4 square yards in 1 hour?
21. While playing ball, some boys broke a window pane $20'' \times 36''$. It cost them \$1.20 to replace it. How much was this per square foot?
Note: The marks " mean inches, just as ' means feet.
22. How many square inches of glass will be required to frame a picture $6''$ by $10''$ if a $3''$ margin of matting is allowed? (Draw a diagram of this problem.)
23. A farmer has a field $\frac{1}{4}$ of a mile wide containing 80 acres. How many rods long is it?
24. A lot 150 feet long sold for \$7500, which was \$2 per square foot. Find its width. What was the selling price per front foot (that is, each foot of width)?

Exercises in Reduction

Do these as fast as you can and get them right. Be sure you know the table.

Change:

1. 1224 sq. in. to sq. ft.
2. 16 sq. ft. to sq. in.
3. 84 sq. ft. to sq. yd.
4. 75 sq. yd. to sq. ft.
5. 80 sq. rd. to sq. yd.
6. 6480 sq. rd. to A.
7. $5\frac{1}{2}$ A. to sq. yd.
8. 10 sq. yd. to sq. in.

9. 12,960 sq. in. to sq. ft.
10. $90\frac{3}{4}$ sq. yd. to sq. ft.
11. 16,445 sq. in. to sq. ft.
12. 8 sq. rd. to sq. in.
13. $15\frac{1}{2}$ sq. ft. to sq. in.
14. 15 A. to sq. rd.

3. Measures of Volume.

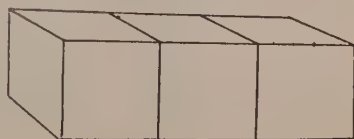
One day Roger and Constance were playing with some blocks that were all the same size. Roger said to Constance, "How big is one of these blocks?" Constance found a rule and measured one of the blocks. She found that it measured one inch, whatever side she measured. Then Roger said, "It is one inch big."

Their mother, who had been listening, explained it to them: "The block is 1 inch high, 1 inch wide, and 1 inch thick. On each side of it there is 1 square inch. But in the whole block there is *one CUBIC* inch. This is what we call the *volume* of the block. Each block has a volume of 1 cubic inch."

Then mother took three of the blocks and laid them side by side, like this:

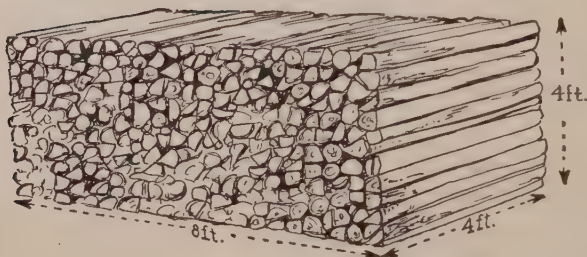
"Now," she said, "what is the volume of wood in these three blocks?"

Can you tell?

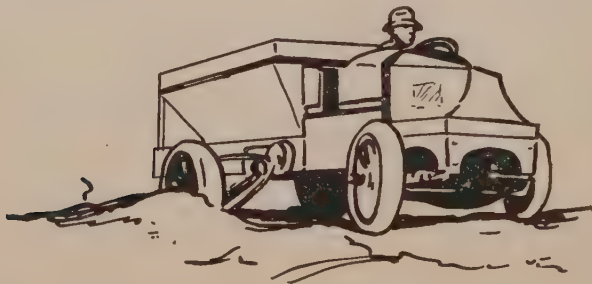


In order to be able to measure the volume of the objects of different sizes we use not only the cubic inch but other units also. They are shown in the following table:

Table of Cubic Measure

 $1728 \text{ cu. in.} = 1 \text{ cu. ft.}$ $27 \text{ cu. ft.} = 1 \text{ cu. yd.}$ $128 \text{ cu. ft.} = 1 \text{ cord}$ 

The cord is one form of measuring wood. A cord of wood is a pile 8 feet long, 4 feet wide and 4 feet high.



When crushed stone is sold for making roads and when dirt is dug and hauled, 1 cubic yard is usually called a load.

$1 \text{ cu. yd. of dirt or crushed stone} = 1 \text{ load}$

Volume is the product of length, height and width.

Problems

1. Frances has a window box that is 6 inches deep, 6 inches wide and 18 inches long. How many cubic inches of dirt will she need to fill it even with the top? How many cubic feet?

Think: Length $\times$ height $\times$ width.

2. A tank 12 feet long and 4 feet wide has 3 feet of water in it. How many cubic feet of water is in it? How many gallons of water will it hold when full? A gallon contains 231 cu. in.
3. A drainage ditch was dug 2 yards wide and 2 feet deep for one-half mile. How many cubic yards of earth were removed?

Think: Can you multiply yards $\times$ feet? What must you do before you can find the number of cubic yards?

4. How many loads of earth were removed in digging a cellar 24 feet long, 20 feet wide and 2 yards deep?

Think: Can you multiply feet $\times$ feet $\times$ yards?

Think: What unit of volume makes one load?

5. A portable typewriter case is $1' \times 10" \times 5"$. Find its volume.
6. A certain schoolroom is 37 feet 6 inches long, 22 feet wide and 12 feet high. How many cubic feet of space is there for each pupil if the room seats 30 pupils?
7. An iceman sells me a cake of ice 18" long, 12" wide and 12" thick. How heavy is it? (One cubic foot weighs $57\frac{1}{2}$ lb.)
8. How many gallons of water would be required to flood a skating rink, 15 feet long and 80 feet wide, to the depth of $\frac{1}{2}$ foot, allowing $7\frac{1}{2}$ gallons to the cubic foot?

9. A coal bin in the basement of John's home measures $12' \times 8' \times 8'$. How many tons of coal will it hold, allowing 49 pounds to the cubic foot?
10. A contractor is excavating a basement $30' \times 40' \times 6'$. He is using the dirt to fill lots that are below grade.
 - a. How many lots $30' \times 100'$ can be filled to the depth of 1 foot?
 - b. How many loads of dirt will he remove?
11. A road commissioner is building a 16-foot road, filling it to a depth of 8 inches with gravel. How many cubic yards will be required to fill a mile?
12. A cistern 10 feet long and 8 feet wide holds 3600 gallons when filled. How deep is it, allowing $7\frac{1}{2}$ gallons to the cubic foot?
13. A swimming tank 40 feet by 18 feet contains 32,400 gallons of water. Find the average depth of the water.
14. An automobile gasoline tank measures $24'' \times 14'' \times 11''$. If this automobile averages 20 miles on 1 gallon of gasoline, how long a trip can be made with one filling? (Allow 231 cubic inches to each gallon.)
15. A pan of boiling maple sap is 10 feet by 4 feet by 8 inches. How many gallons of sap will it hold?
16. Mr. Davis has a wheat bin in his granary which measures $10' \times 8' \times 6'$. How many bushels will it hold, estimating $1\frac{1}{4}$ cubic feet for a bushel?
17. A farmer sold a mow of hay at \$15 per ton. The mow was 30 feet long, 25 feet wide and 20 feet deep. Allowing 343 cubic feet to a ton, how much did he receive?

18. A farmer has a pile of 4-foot wood, 100 feet long and 5 feet high. How much will he receive for it at \$8 a cord?
19. In digging a subway under a certain street, the excavation was made 40 feet wide and 12 feet deep. How many cubic yards of dirt were removed from each block, allowing eight blocks to a mile?
20. Mr. James is building a house 35 feet square with a basement under the entire house. How many loads of dirt must be removed if the excavation is to be 6 feet deep?
21. If the foundation walls extend 2 feet above the ground, how many perches of stone are required, if the walls are 1 foot thick? (One perch = $24\frac{3}{4}$ cubic feet.)
22. How many gallons of water in an aquarium 14" wide, 12" deep and 44" long, if it is filled $\frac{3}{4}$ full?



Exercises in Reduction

Be sure you know the table for cubic measure. Work fast, but use care:

1. Change 4320 cu. in. to cu. ft.
2. Change $11\frac{1}{2}$ cu. ft. to cu. in.
3. Change $2\frac{7}{8}$ cords to cu. ft.

4. Change 1 cu. yd. to cu. in.
5. Change 93,312 cu. in. to cu. yd.
6. Change 1024 cu. ft. to cords.
7. Change 2 cords to cu. in.
8. Change $5\frac{1}{3}$ cu. yd. to cu. ft.
9. Change 4 cords to cu. ft.
10. Change 864 cu. in. to cu. ft.

4. Measures of Capacity.

What are some things that you buy at the grocery store by the peck? By the bushel?

What are some things that you buy by the quart? By the gallon?

Tables of Capacity

Dry Measure

2 pt. = 1 qt.

8 qt. = 1 pk.

4 pk. = 1 bu.

Liquid Measure

4 gills = 1 pt.

2 pt. = 1 qt.

4 qt. = 1 gal.

The bushel contains $2150\frac{1}{2}$ cu. in.

The gallon contains 231 cu. in.



Problems

1. Mrs. Smith had a boarding house. She used 2 pecks of potatoes Tuesday, $1\frac{1}{2}$ pecks Wednesday, $2\frac{1}{2}$ pecks Thursday, $1\frac{1}{4}$ pecks Friday and $3\frac{3}{4}$ pecks Saturday. How many bushels did she use in the five days?
2. If she bought 50 bushels of potatoes and averaged $2\frac{1}{2}$ pecks a day, how many days would the potatoes last?
3. There are four children in the family. Each drinks a pint of milk at every meal each day. How many quarts are used in one day?
4. John picked a bushel of cherries to sell. He put half in quart boxes that sold for 25¢ a box, and half in pint boxes that sold for 15¢ a box. How much did he receive for the bushel of cherries?
5. He picked a bushel of cherries for his mother to can. Allowing $\frac{1}{4}$ waste for stems and seeds, how many quarts did she can from the bushel?
6. Mr. Smith bought 3 bushels of peaches and divided them equally among himself and two of his neighbors. How many pecks did each get? The peaches cost \$2.25 a bushel. How much did each pay?
7. Mrs. Smith used 2 ounces of sugar for each quart of cherries she canned. How many pounds of sugar were used in canning 3 bushels of cherries?
8. John bought onion sets, weighing 28 pounds to the bushel. He bought 8 quarts. How much did they weigh?
9. James sold tomatoes at \$.35 a half-peck, receiving \$5.60. How many bushels did he sell?

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10. He sold potatoes at \$.50 a peck and received \$8.50. How many bushels did he sell?
11. How many baskets, each holding 2 pecks, are required to hold $8\frac{1}{2}$ bushels?
12. How many pint bottles can be filled with $6\frac{1}{2}$ quarts of milk?
13. If milk is 7¢ a pint, what will 4 quarts of milk cost?
14. Mrs. Williams, who serves the milk at the Lincoln School, ordered 64 half-pints of milk for the pupils. How many quarts did she buy? At 14 cents per quart how much did the milk cost?
15. Grace's mother ordered $\frac{1}{2}$ pint of cream at 16 cents, 1 quart of milk at 14 cents, every morning for a month (28 days), one pound of butter each week at 52 cents, and 5 dozen eggs during the month at 35 cents. How much was her bill for the month?
16. Virginia and Alice had a lemonade stand together. They made two gallons of lemonade for 78 cents and sold it for 5 cents per half-pint. How much did each girl make?
17. If a farmer sows $4\frac{1}{2}$ quarts of timothy seed to the acre, how many bushels will a forty-acre field require?
18. A grocer buys potatoes by the bushel (60 pounds) at \$1.40. If he sells them so as to make a profit of 40 cents on the bushel, how much should a customer pay for 10 pounds?
19. Think of some problem outside of school you have recently had to work in measuring. State the problem and tell how you worked it.

Exercises in Reduction

Do these as fast as you can. Try to get every one right. If you have to look back at the tables it means you should study them more:

1. Change 74 qt. to pk.
2. Change 85 qt. to gal.
3. Change 55 pt. to qt.
4. Change 90 pt. to gal.
5. Change 70 gal. to qt.
6. Change 56 bu. to pk.
7. Change 25 bu. to qt.
8. Change 756 pk. to bu.
9. Change 16 qt. to gills.
10. Change 12 bu. to pt.
11. Change 924 cu. in. to gal.
12. Change 8 bu. to cu. in.
13. Change 250 gal. to cu. in.
14. Change 4301 cu. in. to pk.

5. Measures of Time.

In what month is your birthday?

Name all the months of the year. Which ones have thirty days? Which ones have thirty-one days? How many days has February?

On what day of the month is your birthday? How many days in the part of the month before it? How many are there in the part of the month after it?

When did the present term of school begin? How many

weeks of school have you had in this term up to the beginning of this week? Can you tell how many months of school you have had in this term? The next table will help you to answer the last questions, and other questions about time:

Table of Time

60 sec. = 1 min.	4 weeks = 1 mo.
60 min. = 1 hr.	12 mo. = 1 yr.
24 hr. = 1 day	100 yr. = 1 century
7 days = 1 wk.	



A common year has 365 days.

A leap year has 366 days.

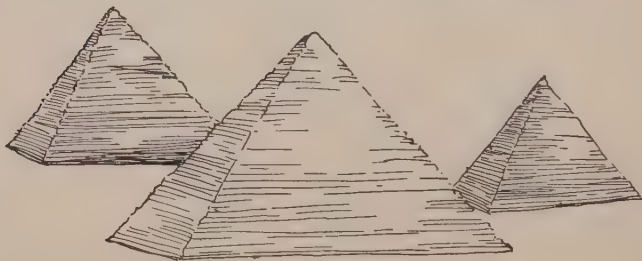
Leap years are all years that you can divide by 4 without remainder, except century years.

Problems

1. Was 1924 a leap year? Was 1923?
2. What was the last leap year before 1924? What is the next leap year after 1924?

3. Century years are leap years when you can divide them by 400, without a remainder. Except for this every fourth year is a leap year.
4. Was 1900 a leap year?
5. Will 2000 be a leap year?
6. Will 2100 be a leap year?
7. Was 1800 a leap year?
8. How many days between Thanksgiving and Christmas of the present year?
9. How old are you? How many months have you lived?
10. How many hours do you go to school each day? How many minutes?
11. How many minutes of recess do you have each day at school? How many do you have in a week of school?
12. You should sleep at least 8 hours out of every 24. How many hours should you sleep in a week?
13. If you sleep 8 hours each day, how many hours do you sleep in a year? How many days of 24 hours each would this make? How many weeks?
14. For Thanksgiving vacation, school closed on Wednesday at 2:30 P. M. and began again on the following Monday at 8:30 A. M. How many hours of vacation were there?
15. Jack went to the movies and stayed 124 minutes. How many hours and minutes did he stay?
16. Tom has a birthday on January 23, and Ben has a birthday on August 14. How many days are there between Tom's birthday and Ben's?

17. In a certain manufacturing company 3300 clocks are turned out finished in $2\frac{3}{4}$ days of 8 working hours a day. How many clocks are made per hour?
18. Baby Jimmy is fed every 4 hours during the 24. How many times a week is he fed?
19. If a man works 5 days out of every week, and each of these days he works 8 hours, how many hours does he work per year, allowing 10 days for holidays?
20. Christmas comes on December 25. How many hours are there left after Christmas before New Year's Day?
21. If it took 20 years to build the Great Pyramid, and 18 years each for the two smaller Pyramids, and 30 days extra were used for ceremonies on each, how many days were spent to complete the three pyramids?



22. On a certain train it takes 5 days to cross the United States. How many hours does it take?
23. A man born in January, 1884, died in December, 1924. How many leap years were there during his lifetime?
24. Rip Van Winkle slept for 20 years. If there were four leap years included, how many days did he sleep?

25. If boys and girls spend $5\frac{1}{2}$ hours each day at school, how many hours are they in school each week? In a school year of 40 weeks?
26. If it took the people in Jules Verne's story 80 days to go around the world, how many weeks did it take them?



27. A man who had sleeping sickness slept for 320 hours. How many days did he sleep?
28. If you have 20 vacation days in 10 months (40 weeks) of school, how many days do you attend school?
29. How many seconds in a year of 365 days?
30. If a farmer goes to bed at half past eight and gets up at half past five, how many hours does he sleep? How many hours is he awake?
31. A man living in the suburbs of Boston spends 45 minutes in the morning going to the city and the same time returning at night. How many hours does he spend thus each week, if he goes to the city 6 days?

32. If you go to school 8 years, and spend 5 hours a day for 5 days a week for 36 weeks each year, how many hours have you spent in school, after you deduct 6 days each year for holidays?
33. Valentine's Day is on February 14. How many days between that day and New Year's Day following?

Exercises in Reduction

You cannot do these examples well unless you know the table for time:

1. Change 2430 min. to hr.
2. Change $24\frac{1}{2}$ hr. to min.
3. Change 30 min. to sec.
4. Change 7230 sec. to min.
5. Change 96 hr. to days.
6. Change $2\frac{1}{2}$ days to min.
7. Change 208 wk. to yr.
8. Change 100 mo. to yr.
9. Change 1928 yr. to centuries.
10. Change 104 wk. to days.

6. Problems for Application and Practice.

1. During a shower 2 inches of rain fell. How many cubic feet fell on a lot having a frontage of 45 feet and a depth of 50 feet?
2. If a cubic foot of granite weighs 165 pounds, what will a block $4' \times 4' \times 3'$ weigh?
3. From some trees Joe gathered $3\frac{1}{2}$ bushels of hickory nuts. He sold them at 15¢ a quart. How much did he receive for them?

4. Mildred's dress had 4 bands of ribbon around the bottom. If her skirt was 54 inches around, how many yards of ribbon did she have to buy?
5. Jane had a birthday party. A quart brick of ice-cream served 6 people. How many gallons did she need for 36 people?
6. Caroline's baby brother drinks 3 pints of milk each day. At 15¢ a quart how much does the milk for him cost each week?
7. Find the cost of 3 pounds of salted peanuts, when they are sold at the rate of 6 ounces for 10 cents.
8. How many square yards in a table cloth measuring 72 inches one way and $3\frac{1}{2}$ yards the other?
9. The outside measurement for a picture is 16 inches by 12 inches. Allowing 4 inches extra for waste, how many feet of molding are needed? If the glass costs 75¢, the cords for hanging 65¢ and molding 25¢ a foot, find the total cost of the picture frame?
10. A telephone connects two farm-houses $\frac{3}{4}$ of a mile apart. How many feet of wire are required for a single line, allowing 10 yards extra at each end for connections.
11. Allowing $7\frac{1}{2}$ gallons to a cubic foot, how many gallons will a tank 6 feet long, 3 feet wide and $8\frac{1}{2}$ feet deep, hold?
12. If potatoes are heaped in baskets, each holding 1 peck, how many bushels and pecks are there in 11 basketsful?
13. How many days is your birthday after Christmas?
14. If you divide 2 pounds 8 ounces of candy among 5 boys, how many ounces will each receive?

15. John went out to play at twenty minutes past two. He promised his mother to come in at 4 o'clock. How long had he to play?
16. Helen practiced on the piano 1 hour and 15 minutes each day. How long did she practice each week, omitting Sunday?
17. Which is heavier and how much, 15 ten-ounce cakes of chocolate or 8 pounds of chocolate?
18. How many yards around a circular running track which is 2640 feet around? What part of a mile around is it?
19. Mary made a blanket for her baby sister. It was 32 inches long and 28 inches wide. How many yards of ribbon were required to bind the edge? How many square inches in the blanket?
20. John made a flower box for his mother. It was 36 inches long, 6 inches deep and 8 inches wide. How many cubic feet of dirt will the box hold?
21. The 14-year-old record for the running broad jump at Grant School was 13 feet 5 inches. If Joe jumped 9 feet 3 inches how much below record was he?
22. The heights of the players of a girls' basket ball team are: 5 feet 3 inches, 5 feet 2 inches, 5 feet 7 inches, 5 feet 8 inches, and 5 feet 4 inches. What is the average height for the girls on this team?
23. The distance around a square is 17 feet 4 inches. How many inches long is each side?
24. A grocer buys peas at \$4 a bushel and sells them at 20¢ a quart. How much profit does he make on each bushel?

25. If a milkman distributes 22 gallons 2 quarts of milk to 60 families so that each receives the same amount, how many quarts does each receive?
26. Two boys have a lemonade stand. They sell 2 gallons of lemonade in $\frac{1}{2}$ -pint glasses at 5¢ a glass. How much money do they take in?
27. How many acres in a field 20 rods long and 16 rods wide? How many feet are required in a fence to go around this field?
28. A boy has a strawberry bed $20\frac{1}{2}$ feet long and 18 feet wide. How many square yards in it?
29. A crate of berries holds 16 quart boxes. At \$4 a crate what is the cost of each 1-quart box?
30. Lucy sold 8 chickens weighing 2 pounds 4 ounces each, at 32¢ a pound. How much did she receive?
31. If a school day of $5\frac{1}{2}$ hours is divided into 45-minute periods, allowing 15 minutes for morning exercises, how many 45-minute periods are there?
32. A coal bin 20 feet long, 16 feet wide is filled to a depth of 7 feet, with hard coal. Allowing 35 cubic feet to a ton, how many tons of coal are there?
33. A farmer raises 3 acres of celery and the yield is 1550 dozen heads to the acre. If he sells them at 2 heads for 5¢, how much money does he receive after selling the entire crop?
34. A man's lot has a frontage of 2 rods 7 feet. How many square feet in his sidewalk if it is $5\frac{1}{2}$ feet wide?
35. When cranberries sell for 22 cents a quart, how much are $1\frac{1}{2}$ pecks worth?

36. What is the distance around a rectangular field 40 rods 12 feet in length, and 30 rods 10 feet in width?
37. In a sewing class a piece of goods 27 yards long was used to make 21 aprons. What was the average amount used for each apron? (Answer in yards and inches.)
38. If one horse eats 12 quarts of oats in one day, how long will 150 bushels of oats last one team of horses?
39. If you study arithmetic 45 minutes each day for 5 days a week, how many hours and minutes do you spend on arithmetic in a week? In a month of 20 school days?
40. How many pint bottles can be filled from 648 gallons of extract?
41. A kindergarten table 4 feet 3 inches long and 20 inches wide is marked off into inch squares. How many such squares are there?
42. Agnes bought three pieces of ribbon. One piece was 1 yard, 12 inches long. One was 2 yards, 6 inches long. The third was 1 yard, 9 inches long. How many yards did she buy?

One Way

$$1 \text{ yd. } 12 \text{ in.} = 1\frac{1}{3} \text{ yd.}$$

$$2 \text{ yd. } 6 \text{ in.} = 2\frac{1}{6} \text{ yd.}$$

$$1 \text{ yd. } 9 \text{ in.} = 1\frac{3}{4} \text{ yd.}$$

$$\underline{\hspace{1.5cm}} \\ 4\frac{3}{4} \text{ yd.}$$

First change the inches to fractions of a yard, and add as mixed numbers.

Another Way

$$1 \text{ yd. } 12 \text{ in.}$$

$$2 \text{ yd. } 6 \text{ in.}$$

$$1 \text{ yd. } 9 \text{ in.}$$

$$\underline{\hspace{1.5cm}} \\ 4 \text{ yd. } 27 \text{ in.} = 4\frac{3}{4} \text{ yd.}$$

Add the inches first.

The sum is 27.

Next add the yards.

The sum is 4.

43. Frank had a board 12 feet long. He needs two pieces each 3 feet, 6 inches long, and one piece 4 feet 8 inches long. How much will be left after these three pieces are cut off?

First add the length of the three pieces. The sum is 11 feet 8 inches. (Work this part for yourself.)

To find the amount left, one must subtract 11 feet 8 inches from 12 feet. This may be done either one of two ways.

One Way

$$\begin{array}{r} 12 \text{ ft.} \\ 11 \text{ ft. } 8 \text{ in.} \\ \hline \end{array} = 12 \text{ ft.} = 11\frac{2}{3} \text{ ft.} \\ \frac{1}{3} \text{ ft.}$$

Reduce the inches to feet and subtract as in mixed numbers.

Another Way

$$\begin{array}{r} 12 \text{ ft.} \\ 11 \text{ ft. } 8 \text{ in.} \\ \hline 4 \text{ in.} \end{array}$$

Take 1 ft. from the 12 ft. Change it to inches and subtract the 8 in. from it. The remainder is 4 in. Instead of 12 ft. there are left now only 11.

44. Work out two ways to add: 2 gallons, 1 quart and 3 gallons, 2 quarts.
45. Work out two ways to add: 2 bushels, 2 pecks and 3 bushels, 1 peck.
46. Work out two ways to subtract: 2 gallons, 1 quart from 3 gallons, 1 quart; to subtract 2 bushels, 1 peck from 3 bushels, 2 pecks.
47. A clerk sold the following lengths from a bolt of gingham: 2 yards, 3 inches; 4 yards, 6 inches; 3 yards, 18 inches. How many yards had she sold in all?
48. If there were 24 yards in the bolt before the sales were made, how many yards were there after the sales?

49. Dick wished to buy lumber enough for 4 pieces each 6 feet, 3 inches long. How many feet should he buy?
50. Ray picked up 1 bushel and 3 pecks of potatoes in the morning, and 1 bushel and 2 pecks in the afternoon. How many bushels did he pick up during the entire day?
51. Add:
- (a) 5 ft. 4 in.; 2 ft. 8 in.; 7 ft. 3 in.
 - (b) 3 bu. 3 pk.; 5 bu. 2 pk.; 1 pk.
 - (c) 1 pk. 2 qt.; 2 pk. 3 qt.; 3 pk. 3 qt.
 - (d) 5 yd. 9 in.; 3 yd. 4 in.; 2 ft.
 - (e) 4 gal. 1 qt.; 5 gal. 3 qt.; 2 gal. 2 qt.
52. Subtract:
- (a) 1 gal. 3 qt. from 2 gal.
 - (b) 2 qt. 2 pt. from 3 qt.
 - (c) 1 pk. 7 qt. from 3 pk. 4 qt.
 - (d) 11 ft. 4 in. from 16 ft. 6 in.
 - (e) 50 yd. 4 ft. from 75 yd. 2 ft.
53. In feeding some calves, Scott uses 1 peck, 2 quarts of meal each day. How much does he use at this rate in one week?

One Way

$$1 \text{ pk. } 2 \text{ qt.} = 1\frac{1}{4} \text{ pk.}$$

$$7 \times 1\frac{1}{4} = 8\frac{3}{4}$$

$$8\frac{3}{4} \text{ pk.} = 2 \text{ bu. } 6 \text{ qt.}$$

Reduce the qt. to a fraction of a pk. and multiply as a mixed number.
Reduce the $8\frac{3}{4}$ pk. to bu. and qt.

Another Way

$$1 \text{ pk. } 2 \text{ qt.}$$

$$\begin{array}{r} 7 \\ \hline 8 \text{ pk. } 6 \text{ qt.} \end{array}$$

Multiply 7×2 and think "14 qt. = 1 pk. 6 qt."

Write the 6 qt. and carry the 1 pk. as in multiplication.

Think " 7×1 plus 1 = 8."

54. Work out two ways to multiply 3 feet, 4 inches by 4; 2 yards, 7 inches by 3.
55. Reba's mother bought 2 quarts, 1 pint of milk each day for 8 days. How much milk did she buy?
56. Doris bought 1 yard, 5 inches of each of 4 kinds of materials. How much did she buy altogether?
57. Mr. Case can put 1 bushel, 1 peck of oats into a certain box. If he fills the box with oats 7 times, how much will he have measured?
58. Multiply:
- 12 ft. 2 in. by 6
 - 7 bu. 5 qt. by 14
 - 27 yd. 10 in. by 7
 - 32 gal. 2 qt. by 8
 - 2 bu. 2 pk. 3 qt. by 5
59. Jordan had 2 yards and 14 inches of ribbon which she wished to cut into 3 pieces of equal lengths. How long should she cut each piece?

One Way

$$\begin{array}{r} 28\frac{2}{3} \text{ in.} \\ 3 \overline{)86 \text{ in.}} \end{array}$$

You cannot divide 2 yd. by 3.

Think, 2 yd. 14 in. = 86 in.

$$86 \div 3 = 28\frac{2}{3}$$

Another Way

$$2 \text{ yd. } 14 \text{ in.} = 2\frac{7}{18} \text{ yd.}$$

$$2\frac{7}{18} \text{ yd.} \div 3 = \frac{4\frac{3}{4}}{3} \text{ yd.}$$

$$\frac{4\frac{3}{4}}{3} \text{ yd.} = 28\frac{2}{3} \text{ in.}$$

Reduce the inches to a fraction of a yard. Divide by three and reduce the quotient to inches.

Which is the shorter method in this problem?

60. Work out two ways to divide 3 gallons, 1 quart by 2; 4 bushels, 2 pecks by 3.

61. Dave divided 3 quarts, 2 pints of popcorn evenly among 4 of his friends. How much did each friend receive?
62. Mr. Albert divided his garden into 7 equal parts. The garden was 37 feet, 8 inches long. How long was each part?
63. Henry wanted to pour the same amount of sugar cane juice into each of three boiling pans. He had 5 gallons, 3 quarts of juice. How much should he pour into each pan?
64. Divide:
- (a) 5 bu. 4 qt. by 7
 - (b) 32 gal. 3 qt. by 9
 - (c) 147 bu. 3 pk. by 15
 - (d) 125 yd. 3 ft. 6 in. by 8

Test Yourself on the Tables

You have now had in this section the tables (with problems) of *length*, *square measure*, *cubic measure*, *dry measure*, *liquid measure* and *time*. This is a good time to see whether you know all these tables. Try this:

Write down in your note-book the heading for each of the six tables. Without looking at your book, write down each table. Then check your work by the text and see how many you have left out or have wrong. If you miss any, review the table and then try writing it again. Keep at this review until you can write all the tables at your best speed without an error. Perhaps your teacher will have you try the same thing again in a week or two.

V. DECIMALS

1. Review of Decimal Orders; the Decimal Point; Meaning of Orders to Right of Point; Practice in Reading and Writing Decimal Notation.

What fraction of a dollar is 65 cents? 13 cents? 59 cents? 25 cents?

Write as a fraction of a dollar 15 cents; 37 cents; 95 cents.

In order to save writing the full fraction, as $\$ \frac{37}{100}$, we write it \$.37, and instead of writing $\$ \frac{59}{100}$, we write it \$.59.

Both of these forms are fractions. $\$ \frac{66}{100}$ is what we call a *common* fraction. We have had this kind of a fraction before. \$.66 is a *decimal* fraction. The dot at the left of the number is called the *decimal point*.

The first place to the right of the decimal point is *tenths*; the second place is *hundredths*; the third place is *thousandths*; the fourth place is *ten-thousandths*; the fifth place is *hundred-thousandths*; and the sixth place is *millionths*.

The name and meaning of each of these places are shown below:

•	2	tenths
	4	hundredths
	3	thousandths
	5	ten-thousandths
	6	hundred-thousandths
	7	millionths

You will readily see that the decimal system runs like the system of writing or reading whole numbers. For example take the number written at the top of page 142:

3	millions	2	hundred-thousands	4	ten-thousands	5	thousands	6	hundreds	3	tens	7	units	.	3	tenths	6	hundredths	5	thousandths	4	ten-thousandths	2	hundred-thousandths	3	millionths
---	----------	---	-------------------	---	---------------	---	-----------	---	----------	---	------	---	-------	---	---	--------	---	------------	---	-------------	---	-----------------	---	---------------------	---	------------

Next above units is *tens*; next below units is *tenths*. Second above units is *hundreds*; second below units is *hundredths*, and so on.

We can write decimal fractions with as many decimal places as we wish. Decimals with more than four places are not often used. Decimals with two and three places are very common.

The value of a figure or the amount represented by it depends upon the place which it occupies.

In the number 5724.4 miles, the value of the figure 7 is 700 miles.

In the number 4172.3 miles, the value of the figure 7 is 70 miles.

In the number 6257.8 miles, the value of the figure 7 is 7 miles.

In the number 8423.75 miles, the value of the figure 7 is 7 tenths of a mile.

In the number 2865.07 miles, the value of the figure 7 is 7 hundredths of a mile.

State the values of 2 in each of the five numbers above.

Write several numbers similar to the ones given just above. Tell the value of the different figures in each.

How to Read Decimals

To read a decimal number: Read as a whole number and give the name of the last place at the right. Zeros immediately after decimal point are not read.

.875 = eight hundred seventy-five thousandths.

.0028 = twenty-eight ten-thousandths.

1.25rd. = one and twenty-five hundredths rods.

Read the following decimal numbers:

- | | | | |
|------------------|-------------------|-------------------|-----------|
| 1. .37 rd. | 5. .9 sq. ft. | 9. .675 bu. | 13. .806 |
| 2. .46 A. | 6. .09 cu. yd. | 10. .842 cu. ft. | 14. .107 |
| 3. .13 min. | 7. .009 in. | 11. .965 lb. | 15. .03 |
| 4. .93 yd. | 8. .42 gal. | 12. .842 qt. | 16. .1039 |
| 17. .125 wk. | 22. .133 dollar | 27. 1.5 oranges | |
| 18. .224 da. | 23. .1007 sq. rd. | 28. 3.25 yd. | |
| 19. .005 yr. | 24. .107 mi. | 29. 2.9 ft. | |
| 20. .05 yr. | 25. .017 sq. yd. | 30. 5.01 sec. | |
| 21. .407 sq. mi. | 26. .17 sec. | 31. 4.002 sq. in. | |

Write in your note-book or on the blackboard as your teacher may direct a list of ten decimal numbers. Then read them. Perhaps your teacher will dictate decimal numbers to write.

Any fraction whose denominator is 10, or 10 with any number of zeros annexed (as 100, 1000, etc.), may be written as a decimal fraction.

Write the following as decimals:

1. $\frac{8}{10}$

5. $\frac{301}{1000}$

9. $\frac{65}{100}$

13. $\frac{3}{10}$

2. $\frac{43}{100}$

6. $\frac{5}{10}$

10. $\frac{107}{1000}$

14. $\frac{4}{1000}$

3. $\frac{5}{1000}$

7. $\frac{4}{100}$

11. $\frac{301}{1000}$

15. $\frac{9}{10000}$

4. $\frac{15}{100}$

8. $\frac{55}{1000}$

12. $\frac{25}{100}$

16. $\frac{54}{10000}$

17. Ninety-two hundredths
18. One hundred six thousandths
19. Forty-five thousandths
20. Forty-five hundredths
21. Seven hundred twenty-four thousandths
22. Seventy-four hundredths
23. Five tenths
24. Ninety-seven thousandths
25. Three hundred eight thousandths
26. Thirty-seven hundredths
27. Forty-six thousandths
28. Seven thousandths
29. Seventy-two thousandths
30. Eight hundredths
31. Sixteen hundredths

Questions

1. What is the name of the first place at the right of the decimal point?
2. What is the name of the second place at the right of the decimal point? Of the third place? Of the fourth place?

Exercises

Read the following decimals:

- | | | |
|-------------|------------|-------------|
| 1. .205 | 7. 1.21 | 13. 205.02 |
| 2. .06 | 8. 106.501 | 14. 5.105 |
| 3. .006 | 9. 62.25 | 15. 2843.32 |
| 4. .0006 | 10. 10.105 | 16. .032 |
| 5. .6506 | 11. .005 | 17. .1156 |
| 6. .0012 | 12. 1.1 | 18. .001 |
| 19. 125.125 | 20. 20.02 | |

2. Adding and Subtracting Decimals.

- Find the sum of these amounts of money: \$.25, \$.63, \$.125, \$.84.
- Would the sum be any different if the amounts were written this way: .25 dollars, .63 dollars, .125 dollars, .84 dollars?

When you add these amounts you really add decimal fractions.

- During the year the rainfall in a certain city was as follows:

January	2.6 inches	July	.07 inches
February	4.11 inches	August	.5 inches
March	5.03 inches	September	6.3 inches
April	4.8 inches	October	4.86 inches
May	1.3 inches	November	7.07 inches
June	2.4 inches	December	3.19 inches

What was the total rainfall for the year?

- A farmer made the following sales from his farm: cows, \$425.50; pigs, \$231.63; wheat, \$1073.24; poultry,

\$75.03; eggs, \$89.05; hay, \$275.47. What was the total amount of his sales?

5. Charles had \$25.33 cents in his savings account. He drew out \$5.25. How much did he have left?

When we write decimal numbers to add them, where must we be careful to place the decimal points? Where do you place the decimal point in the result?

Write out a rule to be followed in adding and subtracting decimal numbers.

Problems

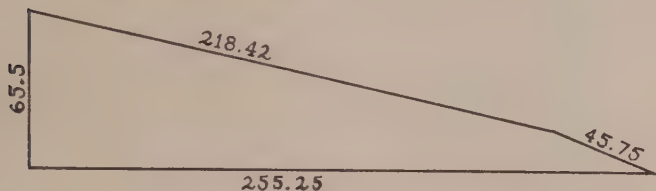
6. What is the distance around a triangular garden whose sides are 4.75 yards, 6.25 yards and 8.5 yards long?
7. Helen paid \$.25 for a handkerchief, \$1.35 for a bottle of perfume and \$.85 for some ribbon. How much did she pay for all?
8. Jane canned 36.5 quarts of fruit, 25.75 quarts of vegetables, 8.25 quarts of soups and 9.5 quarts of jellies. How many quarts did she can in all?
9. The rainfall in New York on five different days was as follows: 1.07 inches, 1.3 inches, .25 inches, 1.09 inches and .75 inches. What was the total rainfall for the five days?
10. A dairyman tested the milk of four cows. Pet showed 4.3 pounds of butter-fat to every 100 pounds of milk; Spot showed 3.93 pounds; Star 4.75 pounds; Jet 4.2 pounds. Find the total number of pounds of butter-fat in 400 lb. of milk, allowing 100 pounds for each cow.

11. In the air mail service a certain plane covered 85.15 miles in the first hour, 96.25 miles the second hour, 98.35 miles the third hour and 75.45 miles the fourth hour. What was the total distance that it covered?
12. During the month of March, Harry deposited the following amounts in his thrift account: \$.35, \$1.02, \$.83, \$.76 and \$.94. How much did he deposit during the month?
13. He withdrew \$.75 to buy a baseball. How much more did he deposit than he withdrew during the month?
14. Grace sold tags on a tag-day for an orphans' home. During the first ten minutes she took in the following amounts: \$.15, \$.22, \$.50, \$.35, \$.25, \$.18 and a dime. What was the total amount she received during that time?
15. The distance from Chicago to Detroit on the Michigan Central R. R. is about 300 miles. An express train leaving Chicago runs 54.55 miles the first hour, 56.35 miles the second hour, 54.7 miles the third hour, 62.28 miles the fourth hour. How many miles does it still have to run to reach Detroit?
16. A man pays \$6000 for his house in 5 payments. He pays \$3000 down. His second payment is \$750.50, his third is \$430.85 and his fourth is \$898.75. Find the amount of his last payment.
17. A girl pays \$4.75 for a pair of shoes and \$4.85 for a hat. How much change should she receive from a \$10 bill?
18. Mr. Morris ordered 9 tons of hard coal, which were delivered in five loads. The first four loads contained

these weights of coal: 1.5 tons, 2.25 tons, 2.9 tons, and 2.85 tons. Did this make more or less than had been ordered?

19. Sarah made the following purchases at a grocery store for her mother: sugar \$.35, butter \$.48, crackers \$.25, cheese \$.32 and coffee \$.53. What change did she receive from a \$2 bill?
20. When we are in good health the body temperature is about 98.6 degrees. Beulah's temperature on Monday was 99.1 degrees, and on Wednesday it was 102.3 degrees. How much too high was it on each of these days?
21. A farmer cut 25 tons of alfalfa. He sold 7.85 tons to one man and 6.25 tons to another. How many tons did he have left?
22. Joseph spent \$2.50 for a pair of skates, \$1.25 for a cap and \$.75 for a hockey stick. How much remained of his weekly wages of \$15?
23. A farmer owning 120 acres of land sold 37.75 acres. How many acres had he left?
24. Victor caught four trout weighing respectively, 1.25 pounds, .875 pounds, 1.625 pounds and 1.5 pounds. What was the total weight of the four fish?
25. Four lots measured together in width 160 feet. Three of them measured 45.8 feet, 38.95 feet and 42.57 feet. How wide was the fourth lot?
26. Which is nearer to five dollars, and by how much, \$4.37 or \$5.79?
27. A land surveyor runs four lines on the sides of a certain lot. The first line is 255.25 feet, the second 65.5

feet, the third 218.42 feet and the fourth 45.75 feet. How many feet of fence are needed to enclose this lot?



28. There are four villages on a certain road. From the first to the second is 9.25 miles, from the second to the third is 7.46 miles and from the first to the fourth is 25 miles. How far is it from the third to the fourth village? (Make a diagram.)
29. Earl has two balls of kite string, one containing 154.375 yards and the other 95.75 yards. How many yards of string has he left if he uses 225.25 yards for his kite?
30. The second floor of a house was 17.625 feet above the floor of the cellar, while the first floor was 7.85 feet above it. How far was it from the first floor to the second floor?
31. A newsboy received \$.78 for his papers on Monday; \$.64 on Tuesday; \$.84 on Wednesday; \$.76 on Thursday; \$.71 on Friday and \$.98 on Saturday. If his papers cost him \$2.25 for the week, what was his week's profit?
32. Eunice spent the following amounts in the school cafeteria for her lunches: Monday \$.28, Tuesday \$.32, Wednesday \$.21, Thursday \$.19 and Friday \$.24. If her allowance for lunches is \$1.50 a week how much did she save this week?

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- 33.** Mrs. Swanson's milk bills for the first six months of the year were as follows:

January, \$4.34	April, \$4.20
February, \$3.92	May, \$4.62
March, \$4.34	June, \$4.42

What was her milk bill for the half year?

- 34.** The sum of two numbers is 2375.425. One number is 1484.3785. Find the other number.
- 35.** A cubic foot of pure gold weighs 1210 pounds. How much heavier is this than a cubic foot of water which weighs 62.5 pounds?

Subtract these decimals, then check:

- | | |
|----------------------|----------------------|
| 1. $72.9 - 8.39$ | 7. $84.076 - 29.84$ |
| 2. $13.038 - 5.927$ | 8. $17.708 - 5.894$ |
| 3. $19.562 - 18.067$ | 9. $352.07 - 74.56$ |
| 4. $160.032 - 29.3$ | 10. $25.01 - 20.009$ |
| 5. $84.245 - .35$ | 11. $1.1 - 1.01$ |
| 6. $200.5 - 150.25$ | 12. $.083 - .0083$ |

Add and check by adding in reverse order:

13. $24.83 + 953.06 + 28.007$
14. $80.08 + 35.308 + 54.56 + 29.029$
15. $3.5685 + 290.8 + 34.0788 + 8.03 + .099$
16. $9.888 + .06 + 25.05 + .0025 + 984.02 + .06$
17. $9.09 + .098 + 100.008 + 26.205 + .175 + 1.25$

Time and Accuracy Practice

Find the sums or differences as indicated. Do your best for a record of time and accuracy. After a few days do the list again, trying to better your record:

1. $3.06 + 25.005 + 684.1 + 88.25 + 1.01 = ?$
2. $75.006 - 15.24 = ?$
3. $340.09 - 203.15 = ?$
4. $18 + 16.24 + 100.01 + 283 + .065 + .01 = ?$
5. From the sum of $76.035 + 185.34 + 24$ subtract 59.03
6. From the difference between 94.05 and 16.28 take 29.04 .
7. $200.2 + 94.001 + 75.75 + 84 + 1.02 = ?$
8. To the difference between 110.82 and 98.03 add 58.025 .
9. To the sum of $.022$ and $.25$ add 54 .
10. $7.009 - 6.29 = ?$

3. Multiplying Decimal Numbers by Integers, and Integers by Decimal Numbers.

1. Grace buys her lunch at school and pays \$.18 each day for it. What do her lunches cost for one week? For one month? (4 weeks.)
2. What is the product of each of the following:
 - a. $\$2.32 \times 5$
 - b. $\$9.86 \times 7$
 - c. $\$7.27 \times 9$
 - d. $\$10.15 \times 11$
 - e. $\$15.42 \times 15$
 - f. $11.2 \text{ bu.} \times 6$
 - g. $16.24 \text{ ft.} \times 12$
 - h. $24.08 \text{ yd.} \times 27$
 - i. $68.28 \text{ A.} \times 125$
 - j. $49.02 \text{ da.} \times 32$

To multiply decimal numbers by whole numbers, or whole numbers by decimals, multiply as if you were working with whole numbers, and in the product point off as many decimal places from the right as there are in either multiplier or multiplicand.

Problems

1. The Lincoln Football Club sold a season ticket for \$1.25. If 48 children bought tickets, how much money did the club take in?
2. Mr. Marsh bought 160 acres of land at \$175.50 per acre. How much did the land cost?
3. A merchant purchased 125 bushels of apples at \$1.35 per bushel. What amount did he pay?
4. At \$.15 each how much will 36 note-book covers cost?
5. How many feet in 35 rods?
6. Find the cost of four pounds of butter at \$.415 per pound.
7. How many pounds are there in .625 of a ton?
8. An automobile averages 32.25 miles an hour. How far does it travel in 16 hours?
9. Find the cost of .375 of a yard of velour at \$8 per yard.
10. A 28-story city building averages 13.875 feet to a story. How high is the building?
11. A cubic foot of ice weighs 57.5 pounds. How much does a cake of ice containing 12 cubic feet, weigh?
12. The boys at a school made a circular running track 80 feet across. What is the length of the track, the distance around being 3.1416 times the distance across.

13. A man paves a street 972 feet long and 29.375 feet wide. How many square feet are paved?
14. At \$.0325 a mile what is the fare from Chicago to Detroit, a distance of 300 miles?
15. Find the weight of water in 65 pounds of turnips, if turnips are .9 water.
16. The rainfall in a certain state averages 3.875 inches per month. Find the rainfall for the year.
17. The living-room in Harry's home contains a rug costing \$100, a three piece furniture set costing \$350, two floor lamps which cost \$65, a library table costing \$45, a writing desk costing \$55, three chairs valued at \$20 apiece, and furnishings costing \$65. If furniture depreciates .12 per year what was the value of the furniture at the end of the first year after it was bought?
18. What is the depreciation in each item of the above problem at the end of one year after its purchase?
19. Mildred's father has an income of \$4200 per year. Of this amount he sets aside .35 for rent, .20 for food, .18 for clothing, .12 for savings and the remainder for recreation, charity and miscellaneous. How much money is set aside for each purpose?
20. How many feet in .75 of a mile? In .875 of a mile? In .1875 of a mile?
21. How much will 15 yards of Brussels carpet cost at \$1.75 a yard? Check.
22. How many square rods in a field 72 rods long and 45.85 rods wide? Check.
23. If five men can do a piece of work in 8.25 days, how long will it take one man to do the work?

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24. How much can a boy save in a year if he puts a nickel a day in his bank?
25. What will .875 tons of coal cost at \$18 a ton?
26. A farmer sold a steer weighing 875 pounds, at \$.075 a pound. What did he receive for it?
27. How many cubic feet in a granary that is 9.5 feet long, 8 feet wide and 5 feet deep?
28. One cubic foot will contain .8 of a bushel. How many bushels of wheat will the above granary hold?
29. A man bought 60 bushels of potatoes at \$.92 per bushel, and sold them for \$75. Did he gain or lose, and how much?
30. How much does a grocer pay for a 340-pound barrel of sugar at \$.055 per pound?
31. If 145.75 bushels of potatoes are raised on one acre of land, how many bushels will a 15-acre field produce?
32. At \$.0175 per pound what will Jacob receive for his mother's old stove, which weighs 78 pounds?
33. A city had a population of 124,876 in 1920. What was its population in 1925 if it increased .25 of its 1920 population?

Multiply:

$$\begin{array}{r} 1. \quad 12.09 \\ \underline{\quad 24} \end{array}$$

$$\begin{array}{r} 3. \quad .075 \\ \underline{\quad 5} \end{array}$$

$$\begin{array}{r} 5. \quad 375 \\ \underline{5.02} \end{array}$$

$$\begin{array}{r} 2. \quad 25.005 \\ \underline{\quad 16} \end{array}$$

$$\begin{array}{r} 4. \quad 9.2 \\ \underline{\quad 92} \end{array}$$

$$\begin{array}{r} 6. \quad 4.008 \\ \underline{\quad 800} \end{array}$$

$$\begin{array}{r} 7. \quad 1.0003 \\ \quad \quad 25 \\ \hline \end{array}$$

$$\begin{array}{r} 9. \quad .0538 \\ \quad \quad 256 \\ \hline \end{array}$$

$$\begin{array}{r} 11. \quad .564 \\ \quad \quad .25 \\ \hline \end{array}$$

$$\begin{array}{r} 8. \quad 175 \\ \quad \quad 1.2 \\ \hline \end{array}$$

$$\begin{array}{r} 10. \quad 26.026 \\ \quad \quad \quad 50 \\ \hline \end{array}$$

$$\begin{array}{r} 12. \quad 5060 \\ \quad \quad .5 \\ \hline \end{array}$$

Speed and Accuracy Practice

Perform these multiplications as fast and as accurately as you can. Keep a record of your time and the number you miss. Try again in a few days for a better record:

$$\begin{array}{r} 1. \quad 175 \\ \quad \quad .05 \\ \hline \end{array}$$

$$\begin{array}{r} 6. \quad .025 \\ \quad \quad 125 \\ \hline \end{array}$$

$$\begin{array}{r} 2. \quad .052 \\ \quad \quad 84 \\ \hline \end{array}$$

$$\begin{array}{r} 7. \quad 756 \\ \quad \quad .423 \\ \hline \end{array}$$

$$\begin{array}{r} 3. \quad 30.5 \\ \quad \quad 24 \\ \hline \end{array}$$

$$\begin{array}{r} 8. \quad 854 \\ \quad \quad 2.56 \\ \hline \end{array}$$

$$\begin{array}{r} 4. \quad 85.25 \\ \quad \quad .15 \\ \hline \end{array}$$

$$\begin{array}{r} 9. \quad 523 \\ \quad \quad 72.5 \\ \hline \end{array}$$

$$\begin{array}{r} 5. \quad .008 \\ \quad \quad 97 \\ \hline \end{array}$$

$$\begin{array}{r} 10. \quad 70.9 \\ \quad \quad 824 \\ \hline \end{array}$$

4. Multiplying and Dividing Decimal Numbers by 10, 100 and 1000.**A. *Multiplying by 10, 100 and 1000.***

1. If one movie ticket costs \$.25, how much will 10 tickets cost? 100 tickets? 1000 tickets?
2. What will 10 2-cent stamps cost? 100 stamps? 1000 stamps? Write the answer as a decimal number.
3. One pair of shoes costs \$4.50. How much do 10 pairs cost? 100 pairs? 1000 pairs?
4. When you multiply a decimal number by 10, what change does that make in the place of the decimal point? What change is made by multiplying the decimal number by 100? By 1000?

Moving the decimal point one place to the right multiplies a number by 10.

Moving the decimal point two places to the right multiplies a number by 100.

Moving the decimal point three places to the right multiplies a number by 1000.

In the following pairs of numbers state which is larger and how much:

1. \$4.50 or \$.45.

Think what the \$.45 must be multiplied by to make \$4.50. Therefore \$4.50 is ten times larger than \$.45.

- | | |
|---------------------------|--------------------------|
| 2. \$.05 or \$.5. | 7. 15.5 yd. or 1.55 yd. |
| 3. .04 A. or .004 A. | 8. 25 yr. or 2.5 yr. |
| 4. 2 in. or .02 in. | 9. 16.25 qt. or 1625 qt. |
| 5. 50 hr. or .5 hr. | 10. 365 days or 36.5 da. |
| 6. 1.01 gal. or 10.1 gal. | 11. 12.5 mo. or .125 mo. |
| | 12. 22.5 pk. or 225 pk. |

Solve the following problems without pencil:

13. An automobile goes at the rate of 25 miles in one hour. How far will it go in 10 hours?
14. A man walks at the rate of 3.25 miles an hour. How far will he walk in 1 day of 10 hours? In 10 days?
15. A man divided his land equally among 10 relatives. Each received 15.65 acres. How much land did he divide?
16. A dealer bought 100 ball bats at \$.85 each. What did they cost him?
17. At \$65 per thousand what will 10 thousand feet of lumber cost?
18. At the orphanage they bought 10 pairs of shoes for \$30. What would it cost to buy 100 pairs at the same rate?
19. If bricks cost \$24 for 1000 what will 10,000 cost?
20. A dealer found pencil tablets quoted at \$3.50 per 100. At this rate what would he have to pay for 1000?

B. Dividing by 10, 100 and 1000.

Which represents the more money, \$.75 or \$7.50? How many times more? By what must you divide the larger to make it equal to the smaller?

Which is the longer time, 36.5 minutes or 365 minutes? By what must you divide the larger to make it equal to the smaller?

How many times taller is a tree that is 600 inches high than a plant 6 inches high?

If 1000 envelopes cost \$2.40, what will 100 cost?

If the Giants pay \$136 per hundred for baseballs what does each ball cost?

When you divide a number by 10 what change does that make in the place of the decimal point? What change is made in the place of the decimal point by dividing the number by 100? By 1000?

Moving the decimal point one place to the left divides a number by 10.

Moving the decimal point two places to the left divides a number by 100.

Moving the decimal three places to the left divides a number by 1000.

Work as many of these as you can without using a pencil:

1. If 1000 ice-cream cones cost \$50, what will 100 cost? What will 10 cost?
2. If ten yards of canton crêpe cost \$35, what does 6 yards cost?
3. If a carton of 100 bars of soap costs \$4, how much is that per bar?
4. A news dealer pays \$60 for 1000 dailies. How much do 100 cost? How much do 10 cost? What is the cost of each?

5. One hundred lead pencils cost \$3. What do they cost apiece?
6. It cost \$32.50 to travel 1000 miles. What was the cost for 100 miles? Per mile?
7. Flags for a Memorial Day Parade cost \$12 for 100. What did each flag cost?
8. A dealer bought a box of 100 chocolate bars for \$6.50. How much was this per bar?
9. It cost \$19.50 to fill a 100-gallon gasoline tank. What was the cost per gallon?
10. Ten one-hour music lessons cost \$45. How much was this for each lesson?
11. If 100 business cards cost \$3.75, how much is this apiece?
12. If 100 small chicks sell for \$8.75, what is the price of one?
13. A ten-ride ticket between two stations costs \$2.75. What is the cost per ride?
14. The weekly payroll of a railroad crew of ten men is \$232. What is the weekly wage of each man?
15. Doctor Howard has some envelopes printed which cost him \$13.75 per thousand. How much is this apiece?
16. His letterheads cost him \$11.25 per thousand. How much is this apiece?
17. If one-half ton of coal costs \$9.50, what is the cost of 30 tons?
18. When cabbage plants sell for \$2.85 per hundred, how much is the cost per plant?

Speed and Accuracy Practice

Try for speed and accuracy in finding these answers.
Use pencil only to write answers:

19. $10 \times \$.85$

27. $$.55 \times 100$

20. 100×55

28. $\$24.75 \div 100$

21. $10 \times \$4.50$

29. $\$16.845 \div 1000$

22. $10 \times \$2.55$

30. $\$34.50 \times 10,000$

23. 100×5.5

31. $\$1.10 \times 100$

24. $\$16.56 \div 10$

32. $\$2.40 \div 100$

25. $254 \div 100$

33. $$.25 \div 10$

26. $9605 \div 1000$

34. $\$6.00 \div 100$

The Camping Trip

One hundred Camp Fire Girls went on a 10-day camping trip.

1. They made the trip to camp by railroad, receiving a reduced fare, which totaled \$185. How much was the fare for each girl?
2. They returned by steamboat, paying \$1.45 for each fare. Did it cost less to go to camp or to return? How much?
3. They ate 100 pecks of potatoes during their outing. What was the cost at \$1.00 per bushel?
4. The total expense for food was \$450. How much was this per day for the entire group?
5. The amount spent for food was divided equally among the girls. How much did each one have to pay?



6. What was the cost of food for each girl for each day of the trip?
7. Mary, Lois and Kate were compelled to do all the dish-washing as a punishment for breaking a rule. If each girl used three dishes at each meal, how many dishes had to be washed for each meal? For each day? For the entire trip?
8. Each girl drank a quart of milk a day. How many quarts were used each day? How many during the ten days?
9. They purchased the milk from a farmer who brought it to camp in 10-quart cans. How many cans did he bring each day? How many cans did he bring during the 10 days?



10. He charged 10 cents a quart for the milk. How much was the value of the milk he sold them each day? How much for the ten days?

The Class Sale at Lincoln School

The children of the sixth-grade class of the Lincoln School are having a fruit and candy sale to raise money for some pictures.

11. They purchase a box of 100 peanut bars for \$3.75. How much do they pay for each bar?
12. If they sell these bars at 10 cents apiece, how much will they receive for the 100 bars?
13. They sell 100 pop corn balls at 4 cents apiece. How much do they receive for them?
14. They receive \$3.50 for a bunch of 100 bananas. What is the amount paid for each banana?
15. What is their profit if the bananas cost them 2 cents apiece?



16. They buy a box of 100 Jonathan apples for \$2.25. What do they pay for each apple?
17. If they make a profit of 2.75 cents on each apple, what do they receive for the box of 100 apples?
18. They pay \$2.00 for a box of peppermint candies which they find contains 1000. At this rate how much does each peppermint cost?
19. How much do they receive for the peppermints by selling them at the rate of 2 for one cent?
20. Jane buys ten oranges at the sale, for 40 cents. What does she pay apiece for them?
21. They cut 10 candy bars into 10 slices each, and sell them at 2 cents a slice. How much do they receive for the 10 bars?
22. Harry buys 10 caramels at the rate of 2 for a cent, and 10 chocolate drops at the rate of 2 cents apiece. What does he pay for his candy?

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23. In totaling the proceeds of their sale they find they have 100 nickels and 100 dimes. How many dollars of each coin do they have?

5. Multiplying with Decimals in both Multiplicand and Multiplier.

1. A suit for Harry costs \$14.50. If the coat costs .5 as much as the whole suit what does the coat cost?

$$\begin{array}{r} \$14.50 \\ \times .5 \\ \hline \$7.250 \end{array}$$

To multiply a decimal by a decimal: Multiply as if both were whole numbers; in the product point off as many places from the right as there are decimal places in both multiplicand and multiplier.

2. The eighth grade rented a park in which to play baseball. The rent which they paid was .2 of the money they received for the sale of tickets. They received \$45.25. How much rent did they pay?

$$\begin{array}{r} \$45.25 \\ \times .2 \\ \hline \end{array}$$

\$9.050 How do you know where to put the decimal point?

3. David saved \$75.65 out of what he earned one summer. His father said that David could have .12 of what he saved, to spend for Christmas. How much did David get for Christmas?

$$\begin{array}{r} \$75.65 \\ \times .12 \\ \hline \$9.0780 \end{array}$$

The answer is \$9.0780. The 8 here means .8 of a cent. It is more than .5 or half of a cent so we call it a whole cent and say that the answer is \$9.08.

Problems in Multiplication of Decimals

1. A farmer shipped a car-load of cattle to Chicago to sell. When he loaded them their average weight was 1275.08 pounds. While on the train the cattle shrank .12 in weight. What did they weigh in Chicago?
2. John's father should have got 30.25 bushels per acre from his wheat crop. Because of lack of rain he got only .33 of a full crop. How many bushels did he get per acre?
3. John has a garden plot which is 24.5 feet long and 12.5 feet wide. How many square feet does it contain?
4. At the rate of \$.025 per mile for gasoline, what will gasoline for a 125.5-mile trip cost?
5. What is the cost of 3.625 yards of canton crêpe at \$4.25 per yard?
6. A field of 40.25 acres yields an average of 3.25 tons of hay per acre. What is the total yield of hay for the field?
7. Find the cost of 225.4 acres of land at \$87.50 per acre.
8. Find the cost of a lot 44.5 feet wide, at the rate of \$67.50 per front foot.
9. James deposited \$.72 in the school bank on bank day. His brother William deposited .5 as much. How much did William deposit?
10. Harry is .4 as old as his father. The father is 42.5 years old. Find Harry's age.
11. Ice weighs .92 as much as water. A cubic foot of water weighs 62.5 pounds. What does a cubic foot of ice weigh?

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12. A gallon of water weighs 8.5 pounds. Milk is 1.03 times as heavy as water. How much does a gallon of milk weigh?
13. The distance around Mr. Jones' vegetable garden is 22.5 rods. How many feet of fence will be required to enclose it? (16.5 ft. = 1 rd.)
14. A boat is traveling at the rate of 16.9 knots per hour. What is its rate in miles per hour? (A knot is 1.15 miles.)
15. Gold coins weigh 25.8 grains per dollar. How many grains in a \$2.50 gold piece?
16. Hard coal sells for \$18.75 per ton. Find the cost of 7.5 tons.
17. A grocer advertised Jonathan apples at \$3.75 per bushel. What would .5 of a bushel cost?
18. Mary requires 4.125 yards of gingham to make a dress. What will her dress cost if she pays \$.56 per yard for her gingham?
19. A grocer sold 7.25 pounds of sugar at \$.085 per pound. What did he charge for the sugar?
20. How much will it cost to fill an automobile gasoline tank holding 14.5 gallons, when gas costs \$.195 per gallon?
21. At \$4.50 per day, how much will a man earn in 5.5 days?
22. How much will 2.125 pounds of meat cost at \$.38 per pound?
23. How many square feet in an Oriental rug that measures 8.25 feet by 4.75 feet?

24. How far will an automobile travel in 3.4 hours, if it averages 27.75 miles per hour?
25. A farmer requires 3.5 bushels of grass seed to sow his meadow. How much will it cost him at \$4.75 per bushel?
26. A laborer receives a weekly wage of \$22.50. He spends .95 of this to support his family. How much does he have left?
27. A farmer pays \$.045 per bushel to thresh his wheat. If the threshing machine tallies 375.5 bushels, how much is his threshing bill?
28. A cask of vinegar contains 25.5 gallons. If .125 of the vinegar leaked out, how many gallons were wasted?
29. Find the cost of 3.25 yards of ribbon at \$.45 per yard.

Speed and Accuracy Test

Every day as you advance through your arithmetic you should accomplish three things:

1. Increase the speed with which you add, multiply, divide and subtract numbers.
2. Improve your accuracy.
3. Learn to think better on problems.

Multiply (page 168). Try for speed and accuracy. Keep a record of your time and mistakes. Do the list again after several days, trying for a better record:

SPEED AND ACCURACY TEST

1. $\begin{array}{r} 2.36 \\ \underline{.18} \end{array}$	9. $\begin{array}{r} .035 \\ \underline{.035} \end{array}$	17. $\begin{array}{r} 3.564 \\ \underline{2.03} \end{array}$
2. $\begin{array}{r} 33.4 \\ \underline{9.6} \end{array}$	10. $\begin{array}{r} 8.0065 \\ \underline{.032} \end{array}$	18. $\begin{array}{r} .9376 \\ \underline{.427} \end{array}$
3. $\begin{array}{r} .0625 \\ \underline{.25} \end{array}$	11. $\begin{array}{r} .03 \\ \underline{.03} \end{array}$	19. $\begin{array}{r} 6.30 \\ \underline{20.1} \end{array}$
4. $\begin{array}{r} 25.001 \\ \underline{1.03} \end{array}$	12. $\begin{array}{r} .204 \\ \underline{40.2} \end{array}$	20. $\begin{array}{r} 758.2 \\ \underline{.143} \end{array}$
5. $\begin{array}{r} 5.05 \\ \underline{4.04} \end{array}$	13. $\begin{array}{r} 84.5 \\ \underline{2.63} \end{array}$	21. $\begin{array}{r} 92.01 \\ \underline{4.61} \end{array}$
6. $\begin{array}{r} 9.034 \\ \underline{.09} \end{array}$	14. $\begin{array}{r} .025 \\ \underline{25.5} \end{array}$	22. $\begin{array}{r} 893.2 \\ \underline{.245} \end{array}$
7. $\begin{array}{r} 19.309 \\ \underline{2.03} \end{array}$	15. $\begin{array}{r} 76.4 \\ \underline{.143} \end{array}$	23. $\begin{array}{r} 7.001 \\ \underline{.302} \end{array}$
8. $\begin{array}{r} .0047 \\ \underline{3.04} \end{array}$	16. $\begin{array}{r} .134 \\ \underline{.245} \end{array}$	24. $\begin{array}{r} 6.321 \\ \underline{13.01} \end{array}$

6. Dividing Decimal Numbers by One-Integer Divisors; Quotients without Remainders.

1. One bushel contains 1.25 cubic feet. How many cubic feet in 2 bushels? What is $2.5 \text{ bushels} \div 2$?
2. Eight gallons of gasoline cost \$1.36. What will 1 gallon cost? What is $\$1.36 \div 8$?

3. An airplane traveled 366.75 miles in three hours. How fast did it go per hour?

$$\begin{array}{r} 122.25 \\ 3 \overline{)366.75} \end{array}$$

Prove that the answer is correct.

When dividing a decimal by a whole number, divide as if both were whole numbers, then point off as many decimal places in the quotient as there are in the dividend.

4. It cost \$157.50 to harvest 1575 bushels of grain. How much did it cost per bushel?

$$\begin{array}{r} .10 \\ 1575 \overline{)157.50} \\ \underline{1575} \\ 0 \end{array}$$

Perform these divisions. Use pencil only to write answers:

- | | | |
|------------------|------------------|---------------------|
| 1. $2.44 \div 4$ | 5. $16.8 \div 2$ | 9. $25.5 \div 5$ |
| 2. $.56 \div 4$ | 6. $2.04 \div 4$ | 10. $3.03 \div 3$ |
| 3. $8.48 \div 8$ | 7. $6.37 \div 7$ | 11. $17.88 \div 4$ |
| 4. $.25 \div 5$ | 8. $.90 \div 6$ | 12. $180.27 \div 9$ |

Problems in Dividing Decimals

1. In a 5-hour trip an airplane traveled 552.5 miles. What was its average speed per hour?
2. A painter receives a weekly wage of \$46.50. What is his daily wage if he works six days a week?

3. A European trip cost a family of 5 the sum of \$4750.75. What was the average cost for each?
4. George went on a motor-boat trip with his father a distance of 66.5 miles. If the trip required 7 hours what was the average speed of the boat?
5. A farmer sold 9 bushels of Jonathan apples for \$17.55. How much was this per bushel?
6. A train covers a distance of 274.5 miles in 9 hours. What is the average speed of the train per hour?
7. A grocer sells 5 pounds of sugar for \$.425. What is the price per pound?
8. A farmer received \$878.50 for his sugar-beet crop at the rate of \$7 per ton. How many tons did he sell?
9. The pupils of the 6-B class deposited \$27.64 on bank day. If there were 18 pupils in the class, what was the average deposit per pupil?
10. The area of a rug is 45.5 square feet. The width is 5 feet. Find the length.
11. If 3 full fares between two cities cost \$9.78 what will one half-fare cost?
12. The girls of a domestic science class purchased 22.75 yards of material to make 7 dresses. How many yards were required for one dress?
13. Tell how you place the decimal point: a. When you divide a decimal by a whole number. b. When you multiply a decimal by a decimal.

7. Review.

Perform the operations indicated with your best speed and accuracy:

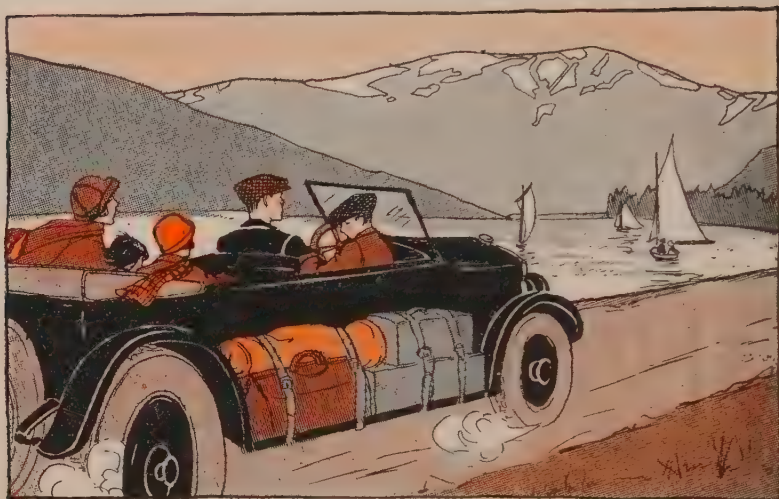
1. $48.26 + 4.735 + 3.83 + 9.65 + .125$
2. $695.34 - 2.405$ Check.
3. $7.007 - .037$ Check.
4. $90.05 + 100.5 + .165 + 83.38 + .009 + 90.09$
5. 84.25×2.5

6. 50.50×50
7. $758 \times .08$
8. 5.75×1.5
9. $7.84 \div 8$ Check.
10. $12.50 \div 5$ Check.

11. $218.5 \div 95$ Check.
12. $925.2 \div 18$ Check.
13. $1.8 \times .85$
14. $55.5 \times .025$
15. 33.5×2.03

An Automobile Trip

1. Mr. Morris bought a used car for .75 of the original price, \$2480. What did he pay for it?
2. He took his family on a trip to northern Wisconsin, a distance of 425.4 miles. They made the trip in 3 days. How many miles did they average per day?
3. At a cost of \$.024 per mile for gasoline, what did the gasoline cost?



4. They rented a boat for \$.75 an hour. They used it the first day 2.5 hours, the second day 3.2 hours, and the third day 1.6 hours. How much rent did they pay for the three days' use?
5. Harry brought his camera. He paid \$.20 apiece for 12 rolls of films. What did they cost?
6. He developed and printed his pictures at an average cost of \$.035 each. When he had this done at the store it cost \$.07 each. What did he save on each picture?
7. How much did he save on 45 pictures?
8. Mary went to a farm-house to buy eggs. She bought 1.5 dozen the first time and 2.75 dozen the second time. How many eggs did she buy altogether?
9. She paid \$.15 a dozen. How much did they all cost?
10. Mr. Morris caught fish that weighed 5.8 pounds, 2.25 pounds, 3.4 pounds, 4.06 pounds and 6.8 pounds.

These would have cost \$.08 a pound if bought at a market. How much would they all have cost?

11. Milk cost them \$.0625 a pint. They used 12 pints. How much did it cost?
12. On the return home they drove 85.5 miles the first day, 150.75 miles the second, 125.8 miles the third and 50.2 miles the fourth day. How many miles did they drive on the return trip?
13. How much shorter was the return route than the route used going?
14. Mr. Morris bought for Mrs. Morris, Harry, Mary and himself 2 sandwiches and a glass of milk apiece. The sandwiches were \$.10 each and the milk \$.05 a glass. How much did the lunches cost?
15. The car needed some repairs. The repair man charged 90 cents an hour. He worked $5\frac{3}{4}$ hours. How much were his charges?
16. Two new tires and inner tubes were purchased. Each tire cost \$18.75. Inner tubes cost \$2.80 each. How much did the tires and tubes cost?

Miscellaneous Problems

1. A certain cow gave 1240.5 pounds of milk in the month of June. Of that amount .0481 was butter-fat. How much butter-fat did she give?
2. The speedometer on Jack's car showed 289.5 miles one morning and 317.9 miles the evening of the same day. How far did the car go that day?
3. A class at school is earning money to buy a picture for their room. They earned \$13.80 from a candy sale

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and \$24.65 from a play. How much more must they earn if the picture is to cost \$50?

4. A train had a run of 275 miles to make. The first hour it traveled 41.6 miles, the second hour 43.25 miles, the third hour 45.125 miles. At the end of the third hour how far had it yet to go?
5. Find the weight of these parcel post packages: the first weighs 2.25 pounds, the second 4.375 pounds, the third 6.5 pounds.
6. What is the difference in the distance covered in 4 hours' traveling at the rate of 16.25 miles an hour, and that covered in the same time at the rate of 18.5 miles an hour?
7. At a rate of \$1.75 a passenger, how much is received from a load of 23 passengers for a ride on an automobile bus?
8. If gasoline costs \$.025 per mile, how much does gasoline cost for a trip of 18 miles?
9. Traveling at the rate of a mile in 3.5 minutes, how long does it take a motor-boat to make a trip 14 miles around the lake?
10. How far is the distance from Chicago to Omaha if it takes a passenger train traveling at the rate of 43 miles per hour, 11.66 hours to cover this distance?
11. The fare between two places is \$6.75. Find the change due from a twenty-dollar bill in buying two full-fare tickets and one half-fare ticket?
12. Cloth is bought at \$1.375 and sold for \$1.50 per yard. Find the amount of profit on 20 yards.

13. If an ocean steamer travels at the rate of 740.5 miles a day, how many miles does it travel in 5.5 days?
14. A lake is 2.75 miles across. A canoe is being paddled across it. When the canoe is out 1.875 miles how much farther has it to go?
15. A mountain trail is 12.25 miles long. Some Camp Fire Girls climb 5.75 miles one day and 4.5 miles the next day. How much farther have they yet to go to the end of the trail?
16. What is the difference in the rate of travel of an aeroplane going at the rate of 92.75 miles an hour, and that of an express train going at the rate of 54.5 miles an hour?
17. The Panama Canal is 49.96 miles long. The Suez Canal is 90 miles long. How much longer is the Suez Canal than the Panama Canal?

VI. GENERAL REVIEW

Large Numbers

Read these numbers. If you are not sure or have to hesitate you should review pages 3 to 8 of the text:

1. In a recent year these amounts of gold were produced by the United States and territories indicated. Read the items:

a. New Mexico,	\$ 404,200
b. Wyoming,	1,100
c. Colorado,	6,707,100
d. Alaska,	7,144,800
e. California,	14,721,600
f. Philippine Islands,	1,526,400

2. In the same year the following states produced the amounts of silver indicated. Read the items:

a. Idaho,	\$ 5,791,413
b. Montana,	9,682,304
c. Arizona,	4,627,738
d. Texas,	653,657
e. Utah,	15,465,202

3. Write these numbers in figures:

- Fifty thousand, nine hundred
- Five hundred sixty-three thousand, four hundred twenty
- Six million, two hundred twenty-five thousand, three hundred five
- One million, twenty-six thousand, one hundred
- One hundred ten thousand, forty-six

Speed and Accuracy Test

See whether you can find the correct sums at the rate of one example a minute:

1.	2.	3.	4.	5.
271	723	224	217	848
735	294	397	326	259
539	967	238	189	386
222	315	784	426	854
235	763	707	979	181
821	126	353	454	321
711	854	613	302	432
663	203	259	673	769
<u>455</u>	<u>952</u>	<u>322</u>	<u>842</u>	<u>547</u>



Subtract, and try for a speed of two examples a minute getting all right:

1.	2.	3.	4.
225864321	93746807	30607338	83336507
<u>80343514</u>	<u>54231910</u>	<u>1682503</u>	<u>26307591</u>

5.	6.	7.	8.
143654070	307041951	130671345	86407965
<u>94360738</u>	<u>93845407</u>	<u>73121406</u>	<u>48218847</u>

Multiply. Try for a speed of better than one a minute, getting all right:

1.	2.	3.	4.
7346	4375	5476	2654
<u>37</u>	<u>84</u>	<u>75</u>	<u>63</u>

$$\begin{array}{r} 5. \\ 4835 \\ \underline{340} \end{array}$$

$$\begin{array}{r} 6. \\ 5876 \\ \underline{45} \end{array}$$

$$\begin{array}{r} 7. \\ 9421 \\ \underline{79} \end{array}$$

$$\begin{array}{r} 8. \\ 3924 \\ \underline{81} \end{array}$$

Divide. Try to get one correct per minute:

$$\begin{array}{r} 1. \\ 42 \overline{)6552} \end{array}$$

$$\begin{array}{r} 2. \\ 59 \overline{)23954} \end{array}$$

$$\begin{array}{r} 3. \\ 24 \overline{)9264} \end{array}$$

$$\begin{array}{r} 4. \\ 78 \overline{)17550} \end{array}$$

$$\begin{array}{r} 5. \\ 37 \overline{)15577} \end{array}$$

$$\begin{array}{r} 6. \\ 56 \overline{)19152} \end{array}$$

$$\begin{array}{r} 7. \\ 64 \overline{)20992} \end{array}$$

$$\begin{array}{r} 8. \\ 65 \overline{)27300} \end{array}$$

Buying and Selling

1. At a bargain sale the store offered to sell with $\$.12\frac{1}{2}$ off on every dollar's worth bought. Mrs. Smith bought goods to the amount of \$12. How much should she pay?
2. Mary and Lucy made 8 pounds of candy to sell. They paid 36 cents for sugar, 10 cents for chocolate, 8 cents for milk, 64 cents for butter. They sold the candy at 50 cents a pound. How much money did they make?
3. John bought $1\frac{1}{4}$ yards of carpet for the floor of their car. The carpet was \$1.80 a yard. What did it cost?
4. A troop of 12 Camp Fire Girls wanted to make bags for their skates. If it took $\frac{3}{8}$ of a yard of cloth for each bag, what would all the cloth cost at 30 cents a yard?
5. Some Boy Scouts wanted to put a strip of bunting across the front of their cabin porch. They measured and found the porch was 16 feet, 6 inches long. What did their bunting cost at 8 cents a yard?

6. John saved 25 cents a week for 28 weeks. Then he wanted to buy a base ball suit which cost \$6.25. Did he have money enough?
7. If the School Board buys pencils at 36 cents a dozen, and sells them to the pupils at cost, what will a pupil have to pay for 4 pencils?
8. If ribbon is selling at 28 cents a yard, what will 27 inches of ribbon cost?
9. Ruth bought $3\frac{1}{2}$ yards of cloth at 24 cents a yard. How much change should she get back from a dollar bill?
10. John worked 8 hours a day at 25 cents an hour. After he had worked $7\frac{3}{4}$ days how much was due him?

Southern Fruit and Vegetables

1. This item appeared in a newspaper: Up to February 20, the railroads report the following carlot shipments out of Florida for the season:

Lettuce	426 cars	Celery	562 cars
Peppers	313 cars	Potatoes	2 cars
Tomatoes	27 cars	Beans	286 cars
Cabbage	201 cars	Strawberries	16 cars
Cucumbers	51 cars	Pineapples	4 cars

- a. How many cars were shipped?
 - b. How many cars were shipped of the four vegetables of which there was most?
2. Mr. Brownell wanted to plant a 10-acre grove of oranges, with 72 trees to the acre. The young trees cost \$.625 each. What did he have to pay for the trees?

3. From another orange grove he owned, Mr. Brownell sold 2460 boxes of oranges at \$3.25 a box. What did he receive for his fruit?
4. If a dealer pays \$4.20 a box for grapefruit that is packed 60 to the box, how much more will he get for the fruit than he paid if he sells at 8 cents for each grapefruit?
5. Mr. Clark has a 10-acre grove of grapefruit that has 64 trees to the acre. His trees averaged 6 boxes to the tree in a recent year. He sold the fruit on the tree for \$1.75 a box. How much did he receive from his grove?
6. If you eat an orange a day for 300 days in the year, what will your oranges cost at 40 cents a dozen?

Questions to Answer

1. If you have the fractions, $\frac{2}{3}$ and $\frac{3}{4}$ to add, what must you do before you can perform the addition?
2. What rule must you follow about decimal points before you can add or subtract decimal numbers?
3. If a multiplier has two decimal places and a multiplicand has three decimal places, how many places do you point off in the product?
4. If a multiplier has three decimal places and a multiplicand has two, how many places do you point off in the product?
5. If you know the number of gallons a pail will hold, how do you find the number of quarts it will hold?
6. If you know the cost of cement paving per square yard how can you find the cost per square foot?

7. If you know what $\frac{2}{3}$ of an article costs how can you find how much the whole will cost?
8. If you know the number of acres in a field how can you find how many square rods in the field?

A Mixed Review

Do these as fast as you can, but remember that accuracy counts most:

1. $\frac{7}{8}$ of 988 = ?
2. $.675 \times 802 = ?$
3. $96 + 4031.52 + 8.0063 + 54 + .75 + 8.9 = ?$
4. $384\frac{6}{7} - 156\frac{1}{2} = ?$
5. $8 - .256 = ?$
6. $3952 \div 7.6 = ?$
7. $386.883 \div 623 = ?$
8. $4.05 \times 45,326 = ?$
9. $8.9625 \times .236 = ?$
10. $\frac{2}{3} \times 5\frac{1}{2} = ?$

Food Problems

1. Apples cost 5 cents for 2. At this rate what will a dozen cost?
2. A certain cereal costs 10 cents a box. A case holding 12 boxes can be bought for a dollar. How much is saved per box by buying by the case?
3. If olive oil costs \$2.50 per gallon, what is the cost of $\frac{1}{2}$ pint?

4. Mrs. Brown buys 3 pints of milk a day. If milk sells at 12 cents a quart what is her milk bill for the month of April?
5. Find the cost of each of the following:
 - a. $4\frac{1}{2}$ lb. bacon at 42 cents
 - b. $3\frac{2}{3}$ lb. round steak at 33 cents
 - c. $2\frac{1}{2}$ doz. eggs at 44 cents
 - d. 20 lb. sugar at 6.75 cents
 - e. 5 lb. coffee at 49 cents
6. What is the total cost of the items given in problem five?

Money and Making Change

1. How much change should you receive from 25 cents for each of the following amounts spent?

<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
\$.15	\$.16	\$.05	\$.10
.12	.19	.20	.23
.09	.22	.17	.04

Think: How much must you *add* to 15 cents to make 25 cents, how much must you add to 12 cents to make 25 cents, and so on.

2. How much change should you receive from 50 cents for each of the following amounts spent? (Think how much you would have to add each time.)

<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
\$.25	\$.40	\$.45	\$.20
.30	.46	.34	.24
.35	.38	.36	.29

3. How much change should you receive from a \$5 bill for each of the following amounts spent?

<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
\$2.50	\$3.50	\$1.20	\$2.70
1.50	4.25	3.75	3.45
1.75	2.75	4.80	2.60

4. Write these amounts in figures:
- Twenty-nine dollars and five cents.
 - Five hundred fifteen dollars and forty cents.
 - Ten dollars and ten cents.
 - Fifty-one dollars.
 - Seventy dollars and seven cents.
 - Three hundred dollars.

The Farm

- A field of corn contains 24 acres. The yield was 1632 bushels. How much was that per acre?
- The farmer sold his corn at 65 cents a bushel. How many dollars did he receive?
- How much did he receive per acre?
- If the cultivation cost \$6 per acre and fertilizing and harvesting \$5 per acre, how much did these expenses cost the farmer?
- A man husking corn received \$4.50 a day. He worked every day in November except four Sundays. How many dollars did he earn?
- A field containing 12 acres of alfalfa yielded $3\frac{1}{2}$ tons per acre. The hay was sold at \$16.50 per ton. What was the amount received for the crop?

7. Mr. Johnson planted $3\frac{1}{2}$ acres of potatoes, which yielded 156 bushels per acre. He kept 25 bushels for his own use and sold the remainder at 65 cents a bushel. How much money did he receive?

A Test

Do these problems and have your teacher grade you on your work:

1. A paper hanger worked for \$8 a day and his helper for \$5 a day. It took them $3\frac{1}{2}$ days to paper Mrs. Brown's rooms. How much did she owe them?
2. Josie's sister, who works in a factory, received 60 cents each for trimming hats. She trimmed $4\frac{1}{2}$ dozen in one week. How much did she receive?
3. Tom had 75 papers. He sold .8 of them at 3 cents each. How much did he get for the papers he sold?
4. A rectangular garden is $5\frac{1}{2}$ yards wide and 16 yards long. How many feet of fence will be required to go around it?
5. Add: $23\frac{1}{3}$; $13\frac{3}{4}$; 7; $8\frac{5}{8}$.
6. Divide: .864 by 1.6.
7. A train averaged 42.25 miles an hour for 5.6 hours. How many miles did it go?
8. James went to the market and bought $3\frac{1}{2}$ pounds of meat at 28 cents a pound, and 3 dozen eggs at 35 cents a dozen. How much change should he get back from 2 one-dollar bills?
9. Oranges were selling at 4 for 15 cents. By the dozen they could be had at 40 cents a dozen. How much

would I save on a dozen by buying them all at once rather than four at a time?

10. Bob's father gave \$15 to the Red Cross and his mother gave \$10. Bob gave $\frac{2}{5}$ as much as his mother. How much did all three give?

Do You Know Your Tables?

Read these statements, saying the proper words where the blanks are left:

- | | |
|------------------------|---------------------------|
| 1. 1 pt. = __gills | 11. 1 sq. yd. = __sq. ft. |
| 2. 1 rd. = __yd. | 12. __rd. = 1 mi. |
| 3. __da. = 1 leap year | 13. 1 sq. ft. = __sq. in. |
| 4. __hr. = 1 day | 14. 1 pk. = __qt. |
| 5. 1 mi. = __ft. | 15. 1 yr. = __wk. |
| 6. 1 mi. = __rd. | 16. 1 cu. ft. = __cu. in. |
| 7. __sec. = 1 min. | 17. __cu. ft. = 1 cu. yd. |
| 8. __ft. = 1 rod | 18. 1 acre = __sq. rd. |
| 9. 1 bu. = __pk. | 19. 1 cord = __cu. ft. |
| 10. __dimes = 1 dollar | 20. 2 gal. = __qt. |

TABLES FOR REFERENCE

Dry Measure

2 pt. = 1 qt.

8 qt. = 1 pk.

4 pk. = 1 bu.

Liquid Measure

4 gi. = 1 pt.

2 pt. = 1 qt.

4 qt. = 1 gal.

31½ gal. = 1 bbl.

63 gal. = 1 hhd.

1 gal. = 231 cu. in.

Cubic Measure

1728 cu. in. = 1 cu. ft.

27 cu. ft. = 1 cu. yd.

1 cu. yd. = a *load*

128 cu. ft. = 1 cord

Linear Measure

12 in. (or ") = 1 ft. (or')

3 ft = 1 yd.

16.5 ft. = 1 rd.

320 rd. = 1 mi.

1760 yd. = 1 mi.

5280 ft. = 1 mi.

Square Measure

144 sq. in. = 1 sq. ft.

9 sq. ft. = 1 sq. yd.

30¼ sq. yd. = 1 sq. rd.

160 sq. rd. = 1 A.

640 A. = 1 sq. mi.

1 sq. mi. = 1 section (land)

36 sq. mi. = 1 township (twp.)

100 sq. ft. = 1 square (roofs, floors)

Circular or Angular Measure

60 sec. (or ") = 1 min. (or')

60 min. = 1 deg. (or °)

90 deg. = 1 right angle

360 deg. = 1 circumference

Avoirdupois Weight

16 oz. = 1 lb.

100 lb. = 1 cwt.

2000 lb. = 1 short ton (T.)

2240 lb. = 1 long ton

TABLES FOR REFERENCE

Weights of Grain by the Bushel

Corn on cob.....	70 lb.
Barley.....	48 lb.
Oats.....	32 lb.
Rye.....	56 lb.
Wheat.....	60 lb.
Clover seed.....	60 lb.
Timothy seed.....	45 lb.

Time Measure

60 sec.	= 1 min.
60 min.	= 1 hr.
24 hr.	= 1 da.
7 da.	= 1 wk.
30 da.	= 1 mo.
12 mo.	= 1 yr.
365 da.	= 1 yr.
366 da.	= 1 leap year
100 yr.	= 1 century

Miscellaneous Measure

12 things	= 1 dozen
12 dozen	= 1 gross
12 gross	= 1 great gross
20 things	= 1 score
24 sheets (paper)	= 1 quire
20 quires	}
480 sheets	
	= 1 ream

Weights of Common Things

A bbl. of flour	= 196 lb.
A bbl. of salt	= 280 lb.
A cu. ft. of water	= 62.5 lb.
400 cu. ft. of hay	= 1 T.
1 bu. of white beans	= 60 lb.
1 bu. of bran	= 20 lb.
1 bu. of shelled corn	= 56 lb.

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